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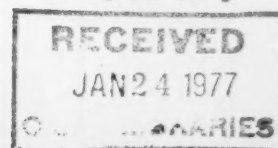
SELECTED  
≡ **WATER**  
**RESOURCES**  
**ABSTRACTS**

TC 1  
S45  
V.10  
no.1

VOLUME 10, NUMBER 1  
JANUARY 1, 1977



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TC 1  
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Jan.-Feb.  
1977

# SELECTED WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center, Office of Water Research and Technology,  
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VOLUME 10, NUMBER 1  
JANUARY 1, 1977

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The Secretary of the U.S. Department of the Interior has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Depart-

ment. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1978.

SELECTED  
WATER RESOURCES  
ABSTRACTS

**A**s the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.



U.S. DEPARTMENT OF THE INTERIOR  
BUREAU OF LAND MANAGEMENT

WATER RESOURCES DIVISION

WATER RESOURCES DIVISION  
BUREAU OF LAND MANAGEMENT  
U.S. DEPARTMENT OF THE INTERIOR  
WASHINGTON, D.C. 20246

Water Resources Division, Bureau of Land Management, U.S. Department of the Interior, Washington, D.C. 20246. This report was prepared by the Water Resources Division, Bureau of Land Management, U.S. Department of the Interior, Washington, D.C. 20246. The report was prepared by the Water Resources Division, Bureau of Land Management, U.S. Department of the Interior, Washington, D.C. 20246. The report was prepared by the Water Resources Division, Bureau of Land Management, U.S. Department of the Interior, Washington, D.C. 20246.

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## FOREWORD

**S**electd Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the **Water Resources Thesaurus**. Each abstract entry is classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT PRESENTLY IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

**Selected Water Resources Abstracts** is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstract-

ing, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency. A directory of the Centers appears on the inside back cover.

Supplementary documentation is being secured from established discipline-oriented abstracting and indexing services. Currently an arrangement is in effect whereby the Bio-Science Information Service of Biological Abstracts supplies WRSIC with relevant references from the several subject areas of interest to our users. In addition to Biological Abstracts, references are acquired from Bioresearch Index which are without abstracts and therefore also appear abstractless in SWRA. Similar arrangements with other producers of abstracts are contemplated as planned augmentation of the information base.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center  
Office of Water Research and Technology  
U.S. Department of the Interior  
Washington, DC 20240

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### 01 NATURE OF WATER

Includes the following Groups: Properties; Aqueous Solutions and Suspensions

### 02 WATER CYCLE

Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

### 03 WATER SUPPLY AUGMENTATION AND CONSERVATION

Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

### 04 WATER QUANTITY MANAGEMENT AND CONTROL

Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Nonwater Activities; Watershed Protection.

### 05 WATER QUALITY MANAGEMENT AND PROTECTION

Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

### 06 WATER RESOURCES PLANNING

Includes the following Groups: Techniques of Planning; Evaluation Process; Cost Allocation, Cost Sharing, Pricing/Repayment; Water Demand; Water Law and Institutions; Nonstructural Alternatives; Ecologic Impact of Water Development.

### 07 RESOURCES DATA

Includes the following Groups: Network Design; Data Acquisition; Evaluation, Processing and Publication.

### 08 ENGINEERING WORKS

Includes the following Groups: Structures; Hydraulics; Hydraulic Machinery; Soil Mechanics; Rock Mechanics and Geology; Concrete; Materials; Rapid Excavation; Fisheries Engineering.

### 09 MANPOWER, GRANTS, AND FACILITIES

Includes the following Groups: Education—Extramural; Education—In-House; Research Facilities; Grants, Contracts, and Research Act Allotments.

### 10 SCIENTIFIC AND TECHNICAL INFORMATION

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## ABSTRACT SOURCES

# SELECTED WATER RESOURCES ABSTRACTS

## 2. WATER CYCLE

### 2A. General

#### STOCHASTIC CONSIDERATIONS IN THUNDERSTORM MODELING.

Northwestern Univ., Evanston, Ill. Dept. of Civil Engineering.

For primary bibliographic entry see Field 2B.  
W77-00087

**A NOMOGRAM TO ESTIMATE THE HEAT-EXCHANGE COEFFICIENT AT THE AIR-WATER INTERFACE AS A FUNCTION OF WIND SPEED AND TEMPERATURE; A CRITICAL SURVEY OF SOME LITERATURE.**  
Keuring van Electrotechnische Materialen N. V., Arnhem (Netherlands). Environmental Dept.  
For primary bibliographic entry see Field 2D.  
W77-00130

#### CATCHMENT MODELING AND INITIAL PARAMETER ESTIMATION AT THE NATIONAL WEATHER SERVICE RIVER FORECAST SYSTEM.

National Weather Service, Washington, D.C. Office of Hydrology.  
E. I. Peck.

NOAA Technical Memorandum NWS HYDRO-31, June 1976. 24 p, 5 fig, 6 ref, 4 append.

Descriptors: \*River forecasting, \*Soil moisture, \*Watersheds(Basins), \*Evapotranspiration, \*Streamflow, Data processing, Groundwater, Percolation, \*Model studies, Hydrology, Calibrations, Drainage, \*Oregon, Precipitation(Atmospheric).

Identifiers: Catchment models, \*South Yamhill River(OR).

The two papers in this technical memorandum were prepared for the International Symposium and Workshop on the Application of Mathematical Models in Hydrology and Water Resources Systems held in Bratislava, Czechoslovakia on 8-13 September 1975. The first 'Catchment Modeling with the United States National Weather Service River Forecast System' describes the system (NWSRFS) of conceptual hydrologic models and other procedures, used in the operational river forecasting program of the United States National Weather Service. A major revision has been made in the soil moisture accounting for the catchment model. The components for soil moisture accounting of the Sacramento Model have replaced those of the modified Stanford Model as used in the original system. The conceptual features and characteristics of the Sacramento Model are discussed. The second paper is titled: 'Calibration of National Weather Service River Forecast System: Initializing Parameters for the Catchment Model'. The use of the catchment model in the NWSRFS requires the determination of 16 model parameters. The calibration process is greatly enhanced if rational initial estimates of model parameters can be found. Techniques are developed to derive initial parameter estimates directly from the hydrometeorological data base of a catchment. Step by step demonstrations of the estimation procedure are included. (NOAA)  
W77-00272

#### THE IMPACT OF MAN ON THE WORLD NITROGEN CYCLE.

Purdue Univ., Lafayette. Dept. of Agricultural Economics.

For primary bibliographic entry see Field 5A.  
W77-00312

#### LINK SLOPE DISTRIBUTION IN CHANNEL NETWORKS.

Brock Univ., St. Catharines (Ontario). Dept. of Geological Sciences.

J-J. Fling.

Water Resources Research, Vol. 12, No. 4, p 645-654, August 1976. 8 fig, 3 tab, 16 ref.

Descriptors: \*Channel morphology, \*Drainage systems, \*Slopes, \*Distribution patterns, \*River basins, Gradients(Streams), Frequency curves, Data collections, Geologic control, Statistics, Histograms, Equations, Model studies, Appalachian Mountain Region.

Identifiers: \*Link slope, \*Appalachian Plateau, Skewed distribution, Stream order, Channel network.

The link slope distribution for given magnitude links from 18 basins in the Appalachian Plateau change from a left skewed, to a normal, to a right skewed distribution resembling a log normal distribution as the average stream gradient decreases. Variations in the link slope distribution can be partly explained by the decrease in the tendency of streams to move downward with a change in available relief or distance and by the effects of local geologic and geomorphic conditions prevailing in a basin. Downstream interior link slopes vary with magnitude following a power function. Their scatter about the log of the power function is constant in most basins. Based on these elementary properties of link slopes and the probability of occurrence of links of any one magnitude, a general model representing the distribution and expectation of interior link slopes for an entire channel network was formulated. The observed interior link slope distributions for different basins varied in shape from a monotonic decrease in frequencies with increasing stream gradient to a unimodal and sometimes bimodal distribution when exterior links were included. In spite of the large changes in the shape of the histograms for different basins, the theoretical distributions provided a good reproduction of the data. (Singh-ISWS)  
W77-00370

#### DATA PROCESSING: A REVIEW OF THE ROLE OF THE MINISTRY OF WORKS AND DEVELOPMENT.

Ministry of Works, Wellington (New Zealand). Water and Soil Div.

For primary bibliographic entry see Field 7C.  
W77-00378

### 2B. Precipitation

#### STOCHASTIC CONSIDERATIONS IN THUNDERSTORM MODELING.

Northwestern Univ., Evanston, Ill. Dept. of Civil Engineering.

R. B. Corotis.

Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 102, No. HY7, Proceedings Paper 12231, p 865-879, July 1976. 8 fig, 1 tab, 33 ref, 2 append. NSF GK-37442.

Descriptors: \*Model studies, \*Rainfall, \*Hydraulics, \*Mathematical models, Probability, Stochastic processes, Hydrology, Statistical models, Thunderstorms, Storms, Storm runoff, Meteorology.

A mesoscale stochastic model of thunderstorm activity was developed to simulate the hourly development of both air mass and squall-line storms. This modeling technique was based on Poisson occurring thunderstorms, Markov cloud formation and movement, and rainfall-producing convective cells, and was intended to provide a more complete theoretical understanding of the thunderstorm process. The rain cells formed according to a prescribed probabilistic model within clouds on an hourly basis, with a relatively high

likelihood of generation of a new cell in the vicinity of a previous cell. The cells were described by a center magnitude with a Gumbel distribution and an exponential or power law decay formula. The stochastic model was programmed for simulation in a fairly general program that allows many different variables in the thunderstorm process to be either prescribed, or simulated from appropriate probability distributions. (Sims-ISWS)  
W77-00087

#### MEDIUM TERM FLUCTUATIONS OF RAINFALL IN SOUTHEASTERN ENGLAND.

University of East Anglia, Norwich (England). Climatic Research Unit.

B. M. Gray.

Quarterly Journal of the Royal Meteorological Society, Vol. 102, No. 433, p 627-638, July 1976. 3 fig, 9 tab, 6 ref.

Descriptors: \*Model studies, \*Rainfall, \*Climatology, \*Precipitation(Atmospheric), Monthly, Climatic data, Fluctuations, Distribution, Temporal distribution, Mathematical models, Forecasting, Meteorology.

Identifiers: \*England, Power spectrum analysis.

An areal average data series based on 18 stations scattered throughout south and east England was set up. The incomplete gamma function was used as a model for the frequency distribution of the data since it gave good agreement with the parameters of the longest record in the area, Kew (1697-1971). The power spectrum of the areal average series showed that non-linear processes on a time scale of months or years may be involved in rainfall fluctuations. Decade average values of the total monthly rainfall of the area series were used to forecast decade mean monthly rainfall totals for 1970-1979, 1980-1989 and 1990-1999, using a mixed time series model. (Sims-ISWS)

W77-00092

#### FINAL REPORT ON AN INVESTIGATION OF PRECIPITATING ICE CRYSTALS FROM NATURAL AND SEEDED WINTER OROGRAPHIC CLOUDS.

Western Scientific Services, Inc., Fort Collins, Colo.

For primary bibliographic entry see Field 3B.  
W77-00096

#### A NOMOGRAM TO ESTIMATE THE HEAT-EXCHANGE COEFFICIENT AT THE AIR-WATER INTERFACE AS A FUNCTION OF WIND SPEED AND TEMPERATURE; A CRITICAL SURVEY OF SOME LITERATURE.

Keuring van Electrotechnische Materialen N. V., Arnhem (Netherlands). Environmental Dept.

For primary bibliographic entry see Field 2D.  
W77-00130

#### THE DESIGN OF AN INEXPENSIVE RAIN GAGE WITH BOTH AMOUNT AND RATE CAPABILITIES.

Kansas Water Resources Research Inst., Manhattan.

D. H. Lenhart, and D. R. Hummels.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-258 770. Price codes: A05 in paper copy, A01 in microfiche. KWRR Contribution No. 181, August 1976. 70 p, 27 fig, 3 tab, 5 ref, 6 append. OWRT A-073-KAN(1), 14-31-0001-6017.

Descriptors: \*Instrumentation, \*Rain gages, \*Precipitation gages, \*Rainfall intensity, Data storage and retrieval, Precipitation intensity, \*Design, Watershed management, Costs.

Identifiers: Battery-operated cassette recorder, Remote data logger, Digital clocks, Precipitation patterns, \*Rainfall rate, Recording rainfall gage, Remote location rain gage.



## Field 2—WATER CYCLE

### Group 2B—Precipitation

Researchers doing work in the general area of water resources often have need of precipitation data. The cost of presently available recording rain gages is high, approximately \$1000. A prototype recording rain gage was built for less than \$200. The prototype can provide both rainfall rate and total rainfall data in a form which is computer compatible. The prototype can operate on batteries in a remote location unattended for one month. The prototype uses a plastic tipping bucket to detect each .01 inch increment of rainfall. When an increment is detected, the time in month, day, hour, minute, and second given by a digital clock is stored in an inexpensive tape cassette storage system. A microprocessor-based system is used to recover the data. The total rainfall is accurate to within 5% of an official Weather Bureau gage with a time accuracy of better than five minutes per month. A complete description of the prototype with results of field tests and recommendations for future improvements is given.

W77-00160

#### MEASUREMENTS OF LIQUID WATER CONTENT IN WINTER CLOUD SYSTEMS OVER THE SIERRA NEVADA,

Nevada Univ., Reno. Desert Research Inst.  
D. Lamb, K. W. Nielsen, H. E. Klieforth, and J. Hallett.  
Journal of Applied Meteorology, Vol. 15, No. 7, p 763-775, July 1976. 12 fig, 9 ref. Bu. Rec. 14-06-D-6632.

Descriptors: \*Clouds, \*Precipitation (Atmospheric), \*On-site investigations, \*Aircraft, \*California, Storms, Sampling, Cloud physics, Measurement, Winter, Data collections, Graphical analysis, Temperature, Dew point, Meteorological data, Meteorology, Nevada. Identifiers: \*Liquid water content, \*Sierra Nevada, \*Lake Tahoe, Aircraft observations.

Investigations of the structure and organization of synoptic-scale storms over the Sierra Nevada Mountain Range during two successive winters (1971-73) were made with a modified B-26 aircraft. Measurements of liquid water content, temperature, and dew point were made along horizontal traverses in a vertical plane oriented roughly perpendicular to the main crest and extending from Lake Tahoe to Sacramento, California. It was shown that the spatial distribution of liquid water was linked to the gross terrain features, as was the surface distribution of precipitation. The main centers of cloud liquid water content tended to form 40-75 km upwind of the main crest in highly convective cells. (Sims-ISWS)

W77-00164

#### A STUDY OF SOME EFFECTS OF VERTICAL SHEAR ON THUNDERSTORMS,

Tennessee Univ. Space Inst., Tullahoma.  
J. Connell.  
Report NASA CR-2647, January 1976. 112 p, 28 fig, 1 tab, 42 ref. NASA NAS8-31197.

Descriptors: \*Thunderstorms, \*Model studies, \*Shear, \*Weather, Tornadoes, Air circulation, Storms, Hail, Rain, Precipitation (Atmospheric), Winds, Meteorology.

Evidence was presented for the existence of vortices and vortex pairs in thunderstorms. A preliminary parameterized model of the nonthermal generation of thunderstorm vortices derived from field observations of storms and laboratory observations of a jet in cross-flow was reported, together with an explanation of how such a model might be used to guide analysis of mesoscale rawinsonde radar, and satellite data toward an improved capability for prediction of thunderstorm motion and growth. Preliminary analyses of radar and satellite data from Atmospheric Variability Experiment IV were used with available rawinsonde data to develop a correlation between wind shears, instability, and thunderstorm motion and

development. Specific studies were recommended for best development of concept and utilization of data from Atmospheric Variability and Atmospheric Variability Severe Storms Experiments. (Sims-ISWS)

W77-00168

#### STATE OF SOUTH CAROLINA WEATHER AND CROP SUMMARIES,

South Carolina Water Resources Commission, Columbia.

For primary bibliographic entry see Field 3F.

W77-00282

#### PROJECT FOG DROPS V - TASK I: A NUMERICAL MODEL OF ADVECTION FOG, TASK II: RECOMMENDATIONS FOR SIMPLIFIED INDIVIDUAL ZERO-GRAVITY CLOUD PHYSICS EXPERIMENTS,

Calspan Corp., Buffalo, N. Y.  
C. W. Rogers, W. J. Eadie, U. Katz, and W. C. Kocmond.  
Report NASA CR-2633, December 1975. 79 p, 3 fig, 3 tab, 35 ref, 1 append. NASA NAS8-30776.

Descriptors: \*Model studies, \*Fog, \*Oceans, \*Cloud physics, Mathematical models, Droplets, Moisture, Humidity, Temperature, Cooling, Winds, Atmosphere, Computer models, Computer programs, Oceanography, Meteorology. Identifiers: \*Advection fog, \*Marine fog, Fog models.

A two-dimensional, numerical model was used to investigate the formation and development of advection fog over the ocean. The model predicted the evolution of potential temperature, horizontal wind, water vapor content, and liquid water content in a vertical cross section of the atmosphere as determined by vertical turbulent transfer and horizontal advection, as well as radiative cooling and drop sedimentation in fog. The model was designed to simulate the formation, development, or dissipation of advection fog in response to transfer of heat and moisture between the atmosphere and the surface as driven by advection over horizontal discontinuities in the surface temperature. Results from numerical simulations of advection fog formation and development were discussed with reference to observational studies of marine fog. Recommendations were presented for an additional numerical modeling investigation to resolve some discrepancies between the predictions of the model and observations of advection fog formation and development over the ocean. A survey of candidate fog or cloud microphysics experiments which might be performed in the low gravity environment of a shuttle-type spacecraft was presented. Recommendations were given for experiments which were relatively simple in nature and relevant to fog modification problems. The appendix contained the model computer program. (Sims-ISWS)

W77-00357

#### CLIMATOLOGICAL NUMERICAL MODELS OF THE SURFACE MIXED LAYER OF THE OCEAN,

Woods Hole Oceanographic Institution, Mass.  
For primary bibliographic entry see Field 2L.

W77-00361

#### MAPPING RUNOFF-PRODUCING ZONES IN HUMID REGIONS,

McGill Univ., Montreal (Quebec). Dept. of Geography.  
For primary bibliographic entry see Field 4A.

W77-00368

#### THE VARIABILITY OF MONTHLY RAINFALL IN SOUTH AUSTRALIA,

Commonwealth Scientific and Industrial Research Organization, Glen Osmond (Australia). Div. of Mathematical Statistics.

E. A. Cornish.

CSIRO Australia Division of Mathematical Statistics, Technical Paper No. 41, 1976. 42 p, 8 fig, 10 tab, 17 ref, 20 maps, append.

Descriptors: \*Rainfall, \*Frequency analysis, \*Variability, \*Period of growth, \*Monthly, Rainfall disposition, Seasonal, \*Australia, Autumn, Winter, Statistical methods, Distribution patterns, Wheat, Crop production. Identifiers: South Australia.

A characteristic feature of autumn weather over a large proportion of the southern Australian wheat belt is that suitable conditions for seeding, germination and early growth are confined to a very limited period; the reliability of rainfall in this period is of paramount importance in providing a favourable start for the crop. The properties of the statistical distribution of monthly rainfall for all months of the year at all observing stations in South Australia have been investigated with the ultimate object of determining the probabilities of obtaining winter rainfall seasons of specified types. Effective rainfalls are calculated according to Prescott's empirical formula, and the probability of obtaining a growing season of given duration beginning in a given autumn month is determined for each observing station. Isopeles of probability have been constructed for the various types of season. Exact fiducial limits for the probabilities are calculated. Similarly effective monthly rainfalls and their exact fiducial limits are calculated for assigned probabilities. (CSIRO)

W77-00443

### 2C. Snow, Ice, and Frost

#### ON THE FRACTURE PROPERTIES OF SNOW,

Montana State Univ., Bozeman.  
R. L. Brown, and T. E. Lang.  
Available from the National Technical Information Service, Springfield, VA 22161 as ADA-022 424. Price codes: A02 in paper copy, A01 in microfiche. Report No. ARO 11042.1-EN, 1975. 12 p, 5 fig, 2 tab, 8 ref. Also in: Snow Mechanics Symposium, (Proceeding of the Grindelwald Symposium, April 1974, IAHS-AISH Publ. No. 114, 1975, p. 196-207. DA-ARO-D-31-124-73-G175, NSF GA-3943.

Descriptors: \*Snow, \*Energy, \*Energy dissipation, \*Free energy, Failure (Mechanics), Deformation, Mechanical properties, Snowpacks, Snow cover, Equations, Mathematical models, Laboratory tests, Stress. Identifiers: \*Snow fractures, Fracture properties.

The fracture characteristics of gradient metamorphosed snow were investigated and interpreted in terms of free energy and energy dissipation within the material. Utilizing continuum thermodynamics, the Helmholtz free energy was developed as a material potential and then used to calculate both free energy and energy dissipation during deformation. Values of these variables at fracture after variable deformation paths were then used to characterize a fracture criterion of snow in terms of dissipation and free energy. A constitutive equation for this type of snow was also developed and reported. (Sims-ISWS)

W77-00083

#### A CONCEPTUAL MODEL OF OFFSHORE PERMAFROST,

Alaska Univ., College. Geophysical Inst.  
T. Osterkamp.

The Northern Engineer, Vol. 7, No. 4, p 5-10, Winter 1975-76. 8 fig, 11 ref. NOAA 40-3-158-41.

Descriptors: \*Permafrost, \*Erosion, \*Coasts, \*Alaska, Cold regions, Beaches, Freezing, Ice, Sea ice, Sea water, Temperature, Water temperature, Model studies, Waves (Water). Identifiers: \*Offshore permafrost, Sub-sea permafrost, Bonded permafrost.

The coastal erosion process was examined for the northern Alaskan coast for the purpose of developing a conceptual model of offshore permafrost. A series of as many as five stages of coastal erosion, which were characterized by different thermal and chemical boundary conditions, were necessary to describe the physical setting of the offshore permafrost. The seasonal variations of the thermal and chemical boundary conditions were discussed and it was suggested that these varying boundary conditions can be incorporated into a model of offshore permafrost consisting of the generalized transport equations from non-equilibrium thermodynamics by successively applying the transport equations to the five stages experienced by a vertical soil profile during the erosion process. (Sims-ISWS)  
W77-00094

**FINAL REPORT ON AN INVESTIGATION OF PRECIPITATING ICE CRYSTALS FROM NATURAL AND SEEDED WINTER OROGRAPHIC CLOUDS.**  
Western Scientific Services, Inc., Fort Collins, Colo.  
For primary bibliographic entry see Field 3B.  
W77-00096

**BEHAVIORAL CHARACTERISTICS AND CLEANUP TECHNIQUES OF NORTH SLOPE CRUDE OIL IN AN ARCTIC WINTER ENVIRONMENT.**  
Department of Transportation, Washington, D. C.; and Coast Guard, Washington, D. C.  
For primary bibliographic entry see Field 5G.  
W77-00230

**EVALUATION OF TECHNIQUES FOR LONG-RANGE FORECASTING OF AIR TEMPERATURE AND ICE FORMATION.**  
National Oceanic and Atmospheric Administration, Ann Arbor, Mich. Great Lakes Environmental Research Lab.  
J. C. Rogers.  
NOAA Technical Memorandum ERL GLERL-8, January 1976. 28 p, 1 fig, 6 tab, 5 ref, 6 append.  
Great Lakes Environmental Research Laboratory Contribution No. 60.

Descriptors: \*Weather forecasting, \*Air temperature, \*Lake ice, \*Freezing, Lakes, e, \*Great Lakes, Iced lakes, Forecasting.  
Identifiers: \*Ice formation, \*Ice forecasting, \*Long-range forecasting(Ice).

Four techniques for making long-range air temperature forecasts were evaluated by using wintertime (November through February) data from around Lakes Superior, Huron, and Michigan. The purpose of the evaluation was to find a technique for forecasting air temperature which could be applied to ice forecasting on the Lakes. The four techniques analyzed were: (1) The use of cycles and oscillations; (2) The extrapolation and kinematic process used by the National Meteorological Center which results in forecasts in the Average Monthly Weather Outlook; (3) Conditional probabilities; and (4) A Markov chain equation. Based on the evaluations, it was found that only the quasi-biennial oscillation (technique 1) category forecasts and the Average Monthly Weather Outlook (technique 2) category forecasts predicted with any skill. Individually, the accuracy of the techniques is only slightly better than chance; however an improved temperature forecasting system for application to ice forecasting could be established by combining them. (NOAA)  
W77-00275

**LONG-RANGE FORECASTING OF MAXIMUM ICE EXTENT ON THE GREAT LAKES.**  
National Oceanic and Atmospheric Administration, Ann Arbor, Mich. Great Lakes Environmental Research Lab.  
J. C. Rogers.

NOAA Technical Memorandum ERL GLERL-7, January 1976. 19 p, 1 fig, 5 tab, 16 ref, 3 append.  
Great Lakes Environmental Research Laboratory Contribution No. 55.

Descriptors: \*Great Lakes, \*Ice, \*Iced lakes, Lakes, \*Forecasting, Weather forecasting.  
Identifiers: Freezing degree-days, \*Long-range forecasts(Ice).

A technique, based on prewinter thawing and wintertime freezing degree-days has been developed for making long-range forecasts of the percent maximum ice extent on the Great Lakes. The number of thawing degree-days is known by early winter, but the crux of the technique is to predict the number of freezing degree-days that will accumulate by March 3, the average date of maximum ice extent on the Lakes during the last 13 winters. This was accomplished by using an average March 3 accumulated freezing degree-day value from both the large and small ice extent winters between 1962-63 and 1968-69, which alternate in a quasi-biennial cycle. The equations and freezing degree-day prediction method were then used to hindcast maximum ice extent on the Lakes during the winters 1969-70 to 1974-75. The results indicated that the regression equation forecasting technique was more accurate than climatology forecasts for Lakes Superior, Michigan, and Huron. For Lake Ontario, climatology forecasts were equally accurate, and for Lake Erie, the small interannual variation in maximum ice extent made climatology forecasting the best technique. (NOAA)  
W77-00276

**FLEXURAL STRENGTH OF LAKE ICE IN RELATION TO ITS GROWTH STRUCTURE AND THERMAL HISTORY.**  
Cold Regions Research and Engineering Lab., Hanover, N.H. Snow and Ice Branch.  
A. J. Gow, and D. Langston.  
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A020 964, Price codes: A03 in paper copy, A01 in microfiche. Research Report No. 349, December 1975. 33 p, 21 fig, 16 tab, 13 ref.

Descriptors: \*Ice, \*Lake ice, \*Strength, \*New Hampshire, Mechanical properties, Yield strength, Testing, On-site investigations, Lakes, Cantilevers, Temperature, Crystals, Stress, Deflection, Measurement, Strength of materials.  
Identifiers: \*Flexural strength, \*Post Pond(NH), \*Mascoma Lake(NH), Cantilever beam tests, Ice strength.

In-place cantilever beam tests on Post Pond and Mascoma Lake ice yielded a maximum flexural strength of 7.1 kg/sq cm. The minimum strength, unrelated to failure along pre-existing cracks in the ice, was 2.9 kg/sq cm. The majority of tests were performed in the push-down mode after it was discovered that beams tested in the pull-up mode, which placed the bottom surface in tension, frequently broke prematurely along cracks in the bottom of the ice. Premature failures of this kind usually occurred at stresses of 2-3 kg/sq cm. Data further demonstrated that the intrinsic strength of lake ice decreased significantly as the surface air temperature went to OC. Ice that had just become isothermal, but had not yet begun to candle, had a strength of about 4 kg/sq cm; ice that had been subjected to prolonged periods of above-freezing air temperatures generally failed at about 3 kg/sq cm. Tests also showed that cold, unrecrystallized snow-ice was as strong as the underlying lake ice. Tests of the effect of crystalline structure indicated that ice composed of crystals with their c-axes horizontal was measurably stronger than ice in which the crystals were oriented with their c-axes vertical. (Sims-ISWS)  
W77-00354

**EFFECT OF POROSITY ON THE HYDROSTATIC COMPRESSION OF ICE.**  
Cold Regions Research and Engineering Lab., Hanover, N.H. Snow and Ice Branch.  
A. J. Gow, and W. Sheehy.  
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A017 302, Price codes: A02 in paper copy, A01 in microfiche. Special Report 234, October 1975. 12 p, 8 fig, 2 tab, 4 ref.

Descriptors: \*Ice, \*Antarctic Ocean, \*Compressibility, \*Laboratory tests, Physical properties, \*Porosity, Cores, \*Hydrostatic pressure, Analytical techniques, Testing, Testing procedures.  
Identifiers: \*Antarctic ice sheet, \*Byrd Station, \*Ice compressibility, Ice cores, Cathetometers.

A cathetometer was used in conjunction with a window-equipped pressure chamber to measure linear deformation in porous polycrystalline ice samples compressed hydrostatically at pressures of up to 0.31 kb. Tests showed that a porosity as little as 1% could increase the compressibility of ice four- or five-fold. However, the compression was of a substantially nonelastic nature, since very little recovery (expansion) occurred during and following pressure release. Pore closure, which was virtually complete at the higher pressures, could be attributed to a combination of plastic and cataclastic deformation of ice in the walls of the pores. (Sims-ISWS)  
W77-00355

**THE GENERATION OF RUNOFF FROM SUBARCTIC SNOWPACKS.**  
Washington Univ., Seattle. Dept. of Geological Sciences.  
T. Dunne, A. G. Price, and S. C. Colbeck.  
Water Resources Research, Vol. 12, No. 4, p 677-685, August 1976. 11 fig, 2 tab, 13 ref. CRREL, DA 4A161102B52E/02.

Descriptors: \*Snowpacks, \*Subarctic, \*Hydrographs, \*Model studies, Runoff, Generators, Snow cover, Diurnal, Waves(Water), Equations, Forecasting.  
Identifiers: \*Subarctic snowpacks, \*Labrador, Diurnal waves, Hillside plots, Vegetative cover, Snow depth, Peak runoff.

A physically-based model of the movement of water through snowpacks was used to calculate hydrographs generated by diurnal waves of snow-melt on the tundra and in the boreal forest of subarctic Labrador. The model was tested against measured hydrographs from hillside plots that sampled a range of aspect, gradient and length, vegetative cover, and snow depth and density. The model yielded good results, particularly in the prediction of peak runoff rates, though there was a slight overestimate of the lag time. A comparison of predictions with field measurements indicated that given the ranges over which each of the controls was likely to vary, the two most critical factors controlling the hydrographs were the snow depth and the melt rate, which must be predicted precisely for short time intervals. Permeability of the snowpack was another important control, but it could be estimated closely from published values. (Roberts - ISWS)  
W77-00372

**ENERGY BALANCE COMPUTATIONS OF SNOWMELT IN A SUBARCTIC AREA.**  
Scarborough Coll., Toronto (Ontario) Div. of Social Sciences-Geography.  
A. G. Price, and T. Dunne.  
Water Resources Research, Vol. 12, No. 4, p 686-694, August 1976. 10 fig, 1 tab, 25 ref.

Descriptors: \*Energy budget, \*Snowmelt, \*Subarctic, \*Model studies, Tundra, Radiation, Turbulent flow, Equations, Runoff, Snow, Latent heat, Mathematical studies, Forecasting.

## Field 2—WATER CYCLE

### Group 2C—Snow, Ice, and Frost

Identifiers: \*Energy balance, Radiation heat flow, Boreal forest, Snowmelt plots, Radiative energy flux, Turbulent energy flux, Slope geometry, Sensible heat.

A physically based model was used to predict daily snowmelt on 2000-sq m plots in the subarctic. The plots had a range of aspects and inclinations under boreal forest and on the tundra. The energy balance, computed for each of the plots, was compensated for differences in radiative and turbulent energy fluxes caused by varied slope geometry and vegetative cover. The turbulent energy fluxes were also corrected for the effects of the stable stratification of the air over the snow surface. The predictions of the model were compared with daily melts derived from runoff measured on the snowmelt plots. The results showed that the method was a good predictor of daily amounts of snowmelt, although some uncertainties were introduced by changes in the snow surface during the melt period. In a companion paper, hourly snowmelt rates, calculated from the energy balance, were used to predict runoff hydrographs from hillside plots. (Roberts-ISWS)  
W77-00373

**SEASONAL CHANGES OF ANTARCTIC PLANKTON IN THE MOLODEZHAYA AND MIRNY REGION,**  
Akademiya Nauk SSSR, Leningrad. Zoologicheskii Institut.  
For primary bibliographic entry see Field 5C.  
W77-00397

### 2D. Evaporation and Transpiration

**A SIMPLE METHOD FOR DETERMINING THE EVAPORATION FROM SHALLOW LAKES AND PONDS,**  
Atmospheric Environment Service, Downsview (Ontario).  
R. B. Stewart, and W. R. Rouse.  
Water Resources Research, Vol. 12, No. 4, p 623-628, August 1976. 9 fig, 13 ref.

Descriptors: \*Evaporation, \*Lakes, \*Energy budget, \*Radiation, Ponds, Equilibrium, Solar radiation, Air temperature, Models, Equations, On-site investigations, Mathematical studies.  
Identifiers: \*Shallow lakes, \*Determining evaporation, \*Hudson Bay lowlands, Summertime evaporation, Bowen ratio, Net radiation, Equilibrium model, Incoming solar radiation.

The summertime evaporation from a shallow lake in the Hudson Bay lowlands was evaluated by the energy budget (Bowen ratio) and equilibrium model approaches. Energy budget calculations revealed that, on the average, 55% of the daily net radiation was utilized in the evaporative process over the lake. Half-hourly and daily values of evaporation were approximated closely by the Priestly and Taylor (1972) model, where the ratio of actual-to-equilibrium evaporation equalled 1.26. A simple model, expressed in terms of incoming solar radiation and screen height air temperature, was developed from the comparison of actual-to-equilibrium evaporation. Tests of the model at a different location indicated that the actual evaporation could be determined within 10% over periods of two weeks. (Roberts-ISWS)  
W77-00127

**A NOMOGRAM TO ESTIMATE THE HEAT-EXCHANGE COEFFICIENT AT THE AIR-WATER INTERFACE AS A FUNCTION OF WIND SPEED AND TEMPERATURE; A CRITICAL SURVEY OF SOME LITERATURE,**  
Keuring van Electrotechnische Materialen N. V., Arnhem (Netherlands). Environmental Dept.  
H. E. Sweers.  
Journal of Hydrology, Vol. 30, No. 4, p 375-401, 1976. 12 fig, 6 tab, 39 ref.

Descriptors: \*Heat exchangers, \*Air-water-interface, Wind velocity, Water, Air temperature, Mathematical studies, Publications, Humidity, Evaporation, Energy budget, Equations.  
Identifiers: \*Nomograms, \*Heat exchange coefficient, Wind speed, Sensible heat transfer, Evaporative heat transfer, Energy balance, Equilibrium temperature, Mass budget studies.

A nomogram was developed to relate the heat-exchange coefficient  $A$  at the air-water interface to the wind speed and to the water surface temperature. An expression for  $A$  was derived from the heat budget, giving  $A$  as a function of the so-called wind-speed function and the surface temperature. The wind-speed function was subject to frequent measurements. Part of the available literature was studied. An expression, based on the work of McMillan, was found to be applicable to conditions in temperate climates. The expression was used to construct the nomogram. (Roberts-ISWS)  
W77-00130

**ENERGY BALANCE COMPUTATIONS OF SNOWMELT IN A SUBARCTIC AREA,**  
Scarborough Coll., Toronto (Ontario) Div. of Social Sciences-Geography.  
For primary bibliographic entry see Field 2C.  
W77-00373

**WATER RELATIONS OF GLYCRRHIZA GLABRA L. UNDER DESERT CONDITIONS,**  
Cairo Univ., Giza (Egypt). Dept. of Botany; and Cairo Univ., Giza (Egypt). Faculty of Science.  
For primary bibliographic entry see Field 2I.  
W77-00500

**EFFECT OF DEHYDRATION AND ELEVATED TEMPERATURE ON LEAF CELL THERMORESISTANCE OF A DROUGHT-SENSITIVE BARLEY CULTIVAR, (IN RUSSIAN),**  
Akademiya Nauk SSSR, Leningrad. Lab. of Cytophysiology and Cytoecology.  
For primary bibliographic entry see Field 2I.  
W77-00503

**WATER BALANCE OF STIPA PENNATA SPP. ERIOCAULIS, STIPA CAPILLATA AND FESTUCA VALLESIAE IN THE STEPPE REGION OF THE UPPER VINSCHAGAU, (IN GERMAN),**  
F. Florineth.  
Oecol. Plant. 9(4), p 295-314, 1974.

Descriptors: \*Grasslands, \*Drought tolerance, Vegetation, \*Grasses, Transpiration.  
Identifiers: Festuca-Vallesiaca, \*Italy, Steppes, Stipa-Capillata, Stipa-Pennata-Ssp-Eriocaulis, Vinschgau.

The water balance and drought resistance of *S. pennata* spp. *ericaulis* Mart. et Skal., *S. capillata* L. and *F. vallesiaca* Schlecht. was measured (in Italy) during the vegetation periods of 1971 and 1972 which differed greatly with respect to the climate. Characteristic for all 3 steppe grasses are their high transpiration values, even in dry periods. Reduction in water loss is only slightly effective, a high sublethal water saturation deficit or sufficient water uptake by a well developed root system, however, compensates for the water loss.-Copyright 1975, Biological Abstracts, Inc.  
W77-00505

### 2E. Streamflow and Runoff

**FLOAT CALIBRATION IN INTEGRATED-FLOAT TECHNIQUES,**  
Department of Scientific and Industrial Research, Taupo (New Zealand). Ecology Div.  
For primary bibliographic entry see Field 7B.  
W77-00088

**MORPHOLOGY OF COBBLE STREAMS IN SMALL WATERSHEDS,**  
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.  
R.-M. Li, D. B. Simons, and M. A. Stevens.  
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 102, No. HY8, Proceedings Paper 12304, p 1101-1117, August 1976. 8 fig, 1 tab, 11 ref, 2 append.

Descriptors: \*Small watersheds, \*Streams, Geomorphology, Hydraulics, Sediments, Mathematical models, Tractive forces, Equations, Channels, Model studies, Design.  
Identifiers: \*Morphology, Hydraulic geometry, Stable channel design, Theoretical studies.

Stream morphology has been studied by many investigators. Most of the studies have been dependent on the statistical interpretation of observed data, and very limited theoretical work has been done to explain the mechanics of the process. As an extension of the work on stable-channel design, the basic equations describing the physical response of stream morphology were employed in this study to derive the hydraulic geometry equations of a channel in coarse alluvium. Both downstream and at-a-station relations were developed. These theoretical results agreed with the field observations. It was found that the conditions of this theoretical approach are valid in watersheds with homogeneous geology but may be valid only in small watersheds with drainage areas on the order of 10 sq miles. (Lee-ISWS)  
W77-00089

**FLOOD HAZARD ANALYSIS: CROOKED RIVER, TOWN OF CASCO, TOWN OF NAPLES, CUMBERLAND COUNTY, MAINE,**  
Soil Conservation Service, Orono, Maine.  
For primary bibliographic entry see Field 4A.  
W77-00100

**FLOOD PLAIN INFORMATION: REPORT ON RANOCAS CREEK, BURLINGTON COUNTY, NJ (SUMMARY REPORT),**  
Army Engineer District, Philadelphia, Pa.  
For primary bibliographic entry see Field 4A.  
W77-00102

**HYDROLOGIC ENGINEERING METHODS FOR WATER RESOURCES DEVELOPMENT, VOLUME 3, HYDROLOGIC FREQUENCY ANALYSIS,**  
Hydrologic Engineering Center, Davis, Calif.  
For primary bibliographic entry see Field 4A.  
W77-00169

**CATCHMENT MODELING AND INITIAL PARAMETER ESTIMATION FOR THE NATIONAL WEATHER SERVICE RIVER FORECAST SYSTEM,**  
National Weather Service, Washington, D.C. Office of Hydrology.  
For primary bibliographic entry see Field 2A.  
W77-00272

**APPENDIX 4, LIMNOLOGY OF LAKES AND EMBAYMENTS, GREAT LAKES BASIN FRAMEWORK STUDY,**  
Great Lakes Basin Commission, Ann Arbor, Mich. Public Information Office.  
For primary bibliographic entry see Field 2H.  
W77-00358

**LINK SLOPE DISTRIBUTION IN CHANNEL NETWORKS,**  
Brock Univ., St. Catharines (Ontario). Dept. of Geological Sciences.  
For primary bibliographic entry see Field 2A.  
W77-00370



## Streamflow and Runoff—Group 2E

**SIMILARITY OF THE MEAN MOTION OF FLUID PARTICLES DISPERSING IN A NATURAL CHANNEL.**  
Geological Survey of Canada, Ottawa (Ontario).  
For primary bibliographic entry see Field 5B.  
W77-00371

**THE GENERATION OF RUNOFF FROM SUB-ARCTIC SNOWPACKS.**  
Washington Univ., Seattle. Dept. of Geological Sciences.  
For primary bibliographic entry see Field 2C.  
W77-00372

**FACTORS AFFECTING SPRING RUNOFF ON TWO FORESTED WATERSHEDS.**  
Forest Service (USDA), Flagstaff, Ariz. Rocky Mountain Forest and Range Experiment Station.  
M. B. Baker, Jr., and A. C. Mace, Jr.  
Water Resources Bulletin, Vol. 12, No. 4, p. 719-729, 7 tab, 12 ref.

Descriptors: \*Runoff, \*Soil water, \*Minnesota, Snowmelt, Water supply, Watersheds (Basins), \*Forest watersheds, Surface waters, Hydrology, Seasonal, Frost, \*Recharge.  
Identifiers: \*Soil frost, Spring runoff, Soil water storage, Soil recharge-runoff.

The spring runoff from two forested watersheds in northern Minnesota was found to be a function of annual snowfall, soil water recharge, and water supply rates. A drainage basin with a clay soil and a hardwood overstory had greater snowmelt and water supply rates than another drainage basin with a sandy soil and conifer overstory. The average soil water recharge rate for the clay soil was 28% less than for the sandy soil. The lower recharge rate of the clay soil resulted in spring runoff which averaged 40% water supplied during the three year study while an average of 2% was produced on the sandy soil. Soil frost which affected soil water recharge varied between soil types and was influenced by amount of soil water storage and snow cover. (Lee-ISWS)  
W77-00374

**ENVIRONMENTAL IMPACT OF STREAM CHANNELIZATION.**  
Baker (Michael), Jr., Inc., Beaver, Pa.  
For primary bibliographic entry see Field 6G.  
W77-00375

**SOME DIFFERENCES BETWEEN DISTRIBUTING AND BRAIDING CHANNELS.**  
Macquarie Univ., North Ryde (Australia). School of Earth Sciences.  
S. J. Riley.  
Journal of Hydrology (New Zealand), Vol. 14, No. 1, p. 1-8, 1975.

Descriptors: \*Distribution, \*Braiding, \*Channels, \*Channel morphology, Rivers, Streams, Surface drainage, Streamflow, Erosion, Sedimentation, Deltas, Bed load.  
Identifiers: \*Distributing channels, \*Braiding channels, \*New Zealand, \*Namo-Gwydir distributing system.

The individual channels of a distributary system develop floodplains that are independent of the parent streams, whereas the channels of a braided system do not develop separate floodplains. With respect to sediment load, bank cohesion, discharge, and slope, the Namo-Gwydir distributary system does not resemble braided systems. The channel patterns of braiding and distributing are sometimes equated and related to similar fluvial processes. This paper proposed a morphological definition for distributaries that will distinguish them from braided streams. Several arguments were presented which suggest that braided and distributary channels are distinctly different with respect to causative fluvial factors. (Sims-ISWS)  
W77-00376

**HYDROLOGIC UNIT MAP--1974, STATE OF IOWA.**  
Geological Survey, Reston, Va.  
For primary bibliographic entry see Field 7C.  
W77-00425

**MEAN ANNUAL RUNOFF IN THE UPPER OHIO RIVER BASIN, 1941-70, AND ITS HISTORIC VARIATION.**  
Geological Survey, Harrisburg, Pa.  
R. M. Beall.  
Open-file report 76-384, May 1976. 41 p, 6 fig, 4 tab, 8 ref.

Descriptors: \*Streamflow, \*Average flow, \*Flow characteristics, \*Ohio River, \*River basins, Runoff, Gaging stations, Maps, Flow rates, Annual, Hydrologic data.  
Identifiers: \*Upper Ohio River basin, 1941-70 mean annual runoff.

A map of the Ohio River basin above the Muskingum River shows patterns of mean annual runoff for the climatologic and hydrologic reference period, 1941-70. The primary data base consisted of 98 long-term gaging-station records collected within this 27,300-square-mile headwater area of the Ohio River basin. Supplemental information was derived from 83 short-term records. Mean annual runoff is at a regional minimum of less than 12 inches in an area extending from the northern West Virginia panhandle to the headwaters of the Mahoning River in Ohio. Mean annual runoff of more than 32 inches occurs in parts of the upper Cheat River basin in West Virginia. The zone of high runoff trends northeastward along the western slopes of the Allegheny Mountains; magnitudes diminish to about 25 inches at the eastern basin boundary near Ebensburg, Pennsylvania. Runoff of this magnitude occurs also in a band across the upper Allegheny River basin in Pennsylvania. Ratios of mean annual discharge to the 30-year reference-period average were computed for each year of record for all long-term gaging stations. Annual discharges have ranged from about 30 percent to 200 percent of the 30-year mean. Graphed summaries of the annual ratios document the relative duration and magnitude of wet and dry periods during the past 65 years in the upper Ohio River basin. (Woodard-USGS)  
W77-00428

**HYDROLOGIC UNIT MAP--1974, STATE OF WYOMING.**  
Geological Survey, Reston, Va.  
For primary bibliographic entry see Field 7C.  
W77-00429

**SURFACE WATER SUPPLY OF THE UNITED STATES, 1966-70: PART 4. ST. LAWRENCE RIVER BASIN--VOLUME 2. ST. LAWRENCE RIVER BASIN BELOW LAKE HURON.**  
Geological Survey, Reston, Va.  
For primary bibliographic entry see Field 4A.  
W77-00431

**DEVELOPMENT OF A STANDARD RATING FOR THE PRICE PYGMY CURRENT METER.**  
Geological Survey, Jackson, Miss.  
For primary bibliographic entry see Field 7B.  
W77-00432

**CHANNEL EROSION SURVEYS ALONG TAPS ROUTE, ALASKA, 1975.**  
Geological Survey, Anchorage, Alaska.  
For primary bibliographic entry see Field 2J.  
W77-00433

**FLOODS OF MARCH-APRIL 1973 IN SOUTHEASTERN UNITED STATES.**  
Geological Survey, Reston, Va.  
G. W. Edelen, Jr., and J. F. Miller.

Available from Supt. of Documents, GPO, Wash., D.C., 20402, \$4.50. Professional Paper 998, 1976. 283 p, 19 fig, 10 tab, 11 ref.

Descriptors: \*Floods, \*Southeast U.S., \*Flood data, \*Streamflow, \*Peak discharge, Rainfall-runoff relationships, Gaging stations, Flood damage, Flood recurrence interval, Reservoirs, Hydrologic data.

Floods during March-April 1973 were the greatest of record on many streams in nine major river basins in seven Southeastern States. The major thrust of the flood extended throughout the central part of the Tennessee River basin and into adjacent basins. Recurrence intervals of peak discharges exceeded 100 years at 28 streamflow gaging stations. Major flooding occurred both on streams with flood-control reservoirs and on those which had none. Substantial reductions in peak stages and discharges in the Cumberland and Tennessee River basins were attained as a result of reservoir storage regulation. Seven lives were lost and total damage reportedly exceeded \$60 million. The report presents an analysis of the storm and rainfall distribution; summaries of flood stages and discharges at 490 streamflow gaging stations, stages and contents of 45 reservoirs, flood crest stages, and hydrograph data consisting of gage height, discharge, and accumulated runoff at selected times at 92 gaging stations. The availability of aerial photographs obtained during the flood is summarized and flood damages are discussed. (Woodard-USGS)  
W77-00434

**ESTIMATION AND SIMULATION OF SHEET RUNOFF.**  
Commonwealth Scientific and Industrial Organization, Canberra (Australia). Div. of Land Use Research.  
For primary bibliographic entry see Field 4A.  
W77-00439

**MAGNITUDE AND FREQUENCY OF FLOODS IN NORTH CAROLINA: TECHNIQUE FOR ESTIMATING THE MAGNITUDE AND FREQUENCY OF FLOODS ON NATURAL STREAMS IN NORTH CAROLINA.**  
Geological Survey, Raleigh, N. C.  
N. M. Jackson, Jr.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-254-411. Price codes: A03 in paper copy, A01 in microfiche. Water-Resources Investigations 76-17, March 1976. 26 p, 8 fig, 2 tab, 19 ref.

Descriptors: \*Floods, \*Flood frequency, \*Frequency analysis, \*Regression analysis, \*North Carolina, Streams, River basins, Natural streams, Gaging stations, Regional analysis, \*Streamflow forecasting, Equations, Maximum probable flood, Drainage area.  
Identifiers: \*Ungaged streams.

Methods are provided to estimate the magnitude and frequency of floods on natural North Carolina streams with drainage areas greater than 0.5 square mile (1.3 square kilometers). For 257 gaged sites, the magnitudes of floods having recurrence intervals from 2 to 100 years are provided in tables. For ungaged sites, equations, graphs, and maps allow estimation of flood magnitudes. Multiple regression techniques were used to define the relation between flood peaks and seven basin and climatic variables. Drainage area is the most significant variable. Inclusion of the other six variables reduced the standard error of estimate less than 4 percent. Regression equations gave consistently different results for stations in the Coastal Plain than for stations in the mountains and Piedmont. Accordingly, stations were divided into two groups and estimating equations were developed for each geographic area. (Woodard-USGS)  
W77-00480

## Field 2—WATER CYCLE

### Group 2E—Streamflow and Runoff

**FLOODFLOW CHARACTERISTICS AT PROPOSED BRIDGE SITE ON FISHKILL CREEK, FISHKILL, NEW YORK,**  
Geological Survey, Albany, N.Y.  
For primary bibliographic entry see Field 4C.  
W77-00483

**MAXIMUM KNOWN STAGES AND DISCHARGES OF NEW YORK STREAMS THROUGH 1973,**  
Geological Survey, Albany, N.Y.  
For primary bibliographic entry see Field 7C.  
W77-00485

**LAKES MARION-MOULTRIE STREAM SYSTEM INVESTIGATION: PART II-SIMULATION STUDIES,**  
Geological Survey, Columbia, S.C.  
For primary bibliographic entry see Field 4A.  
W77-00488

### 2F. Groundwater

**CHEMICAL WEATHERING OF GLAUCONITE,**  
Tripoli Univ., Libya. Dept. of Soil and Water Sciences.  
For primary bibliographic entry see Field 2K.  
W77-00289

**THE ACTIVITY CONCEPT OF PHOSPHATE-ROCK SOLUBILITY,**  
International Fertilizer Development Center, Florence, Ala.  
For primary bibliographic entry see Field 2K.  
W77-00290

**THE MECHANISM OF PHOSPHATE FIXATION BY IRON OXIDES,**  
Griffith Univ., Nathan, (Australia).  
For primary bibliographic entry see Field 2K.  
W77-00291

**GEOLOGIC NITROGEN IN PLEISTOCENE LOESS IN NEBRASKA,**  
Nebraska Univ., Lincoln. Dept. of Agronomy.  
For primary bibliographic entry see Field 5B.  
W77-00366

**TOWARDS A COMPUTER-BASED INFORMATION-RETRIEVAL SYSTEM FOR GROUND-WATER DATA,**  
New Zealand Geological Survey, Christchurch.  
For primary bibliographic entry see Field 7C.  
W77-00377

**HYDROGEOLOGIC DATA FROM THE GREAT BEND PRAIRIE, SOUTH-CENTRAL KANSAS,**  
Geological Survey, Lawrence, Kans.  
For primary bibliographic entry see Field 4B.  
W77-00426

**GROUND-WATER LEVELS IN THE UNITED STATES, 1970-74: SOUTH-CENTRAL STATES.**  
Geological Survey, Reston, Va.  
For primary bibliographic entry see Field 4B.  
W77-00430

**EFFECTS OF NEAR-WELL PERMEABILITY VARIATION ON WELL PERFORMANCE,**  
New South Wales Univ., Kensington (Australia). Water Research Lab.  
For primary bibliographic entry see Field 4B.  
W77-00437

**DRILLING MUD INVASION OF UNCONSOLIDATED AQUIFER MATERIALS,**  
New South Wales Univ., Kensington (Australia). Water Research Lab.  
For primary bibliographic entry see Field 8B.  
W77-00438

**GROUND-WATER DISCHARGE FROM THE EDWARDS AND ASSOCIATED LIMESTONES, SAN ANTONIO AREA, TEXAS, 1975,**  
Geological Survey, Austin, Tex.  
For primary bibliographic entry see Field 4B.  
W77-00479

**DIGITAL SIMULATION OF A BASALT AQUIFER SYSTEM, WALLA WALLA RIVER BASIN, WASHINGTON AND OREGON,**  
Geological Survey, Tacoma, Wash.  
For primary bibliographic entry see Field 4B.  
W77-00481

**DIGITAL-MODEL ANALYSIS TO PREDICT WATER LEVELS IN A WELL FIELD NEAR COLUMBUS, INDIANA,**  
Geological Survey, Indianapolis, Ind.  
For primary bibliographic entry see Field 4B.  
W77-00482

**GROUND-WATER DATA FOR ATTALA COUNTY, MISSISSIPPI,**  
Geological Survey, Jackson, Miss.  
For primary bibliographic entry see Field 7C.  
W77-00484

**CHANGES IN THE WATER SUPPLY IN THE UPPER REPUBLICAN NATURAL RESOURCES DISTRICT, SOUTHWEST NEBRASKA, FROM 1952-75,**  
Geological Survey, Lincoln, Nebr.  
For primary bibliographic entry see Field 4B.  
W77-00489

**ONE-DIMENSIONAL SIMULATION OF AQUIFER SYSTEM COMPACTION NEAR PIXLEY, CALIFORNIA: 2. STRESS-DEPENDENT PARAMETERS,**  
Geological Survey, Menlo Park, Calif.  
D. C. Helm.  
Water Resources Research, Vol 12, No 3, p 375-391, June 1976. 12 fig, 1 tab, 22 ref.

Descriptors: \*Land subsidence, \*Model studies, \*Aquifer systems, \*California, Methodology, Aquitards, Hydraulic conductivity, Specific retention, Water storage, Compaction, Aquifer characteristics, \*Simulation analysis, Computer models.

A major problem facing hydrologists is how to predict land subsidence. A key to this problem is the development of a reliable method for evaluating aquitard parameters. For assumed values of hydraulic conductivity and storage, vertical compaction and expansion of idealized aquitards can be computed (predicted) by an appropriate diffusion equation from known (projected) water level changes in adjacent aquifers. If water levels within the aquifers are observed and the resulting field compaction and expansion are measured, the parameters themselves can be evaluated. Such field measurements are available at a site near Pixley, California, for the composite behavior of a series of 21 doubly draining aquitards. By means of a linear partial differential equation with constant coefficients within one digital model, average hydraulic conductivity for idealized aquitards was evaluated from the field data to be 3000 ft/yr, and average nonrecoverable specific storage was evaluated to be 0.00023 ft. A second model allows parameters of nonrecoverable compaction to be stress dependent by assuming for any single material that the product of hydraulic conductivity and an incremental effective stress is a

constant and that the product of nonrecoverable specific storage and past maximum effective stress is a constant. (See also W75-08826) (Woodward-USGS)  
W77-00490

### 2G. Water In Soils

**ENVIRONMENTAL IMPACT OF CADMIUM AND OTHER HEAVY METALS FROM LAND-APPLIED SEWAGE SLUDGE,**  
Wisconsin Univ., Madison. Dept. of Soil Science.  
For primary bibliographic entry see Field 5C.  
W77-00002

**MODELING INFILTRATION AND REDISTRIBUTION OF SOIL WATER DURING INTERMITTENT APPLICATION,**  
Minnesota Univ., St. Paul. Dept. of Agricultural Engineering.  
L. G. James, and C. L. Larson.  
Transactions of the American Society of Agricultural Engineers, Vol. 19, No. 3, p 482-488, May-June 1976. 7 fig, 4 tab, 22 ref.

Descriptors: \*Infiltration, \*Infiltration rates, \*Soil physics, \*Unsaturated flow, \*Soil water movement, \*Unsteady flow, Soils, Porous media, Equations, Soil properties, Mathematical models, Laboratory tests, Computers.

A model that used relatively simple and reasonably accurately measured parameter equations was used to represent infiltration and redistribution of soil water during intermittent water applications. Application of the model was limited to short time periods since evapotranspiration was neglected and only impervious and air-soil interface type lower boundaries to the soil zone were considered. The soil was required to be homogeneous and to have distinct wetting fronts. Laboratory data were collected and compared with the model predictions. The model was found to predict satisfactorily the runoff quantities and timing, the volume of water stored in the soil, and the soil moisture profiles including the position of the wetting front. The model over-predicted the infiltration rate when the application rate exceeded the infiltration capacity of the soil. (Adams-ISWS)  
W77-00093

**DISPOSITION OF FERTILIZER NITRATE APPLIED TO A SWELLING CLAY SOIL IN THE FIELD,**  
Texas Agricultural Experiment Station, College Station.  
For primary bibliographic entry see Field 5B.  
W77-00144

**PORE VOLUME DISTRIBUTION AND CURVE OF WATER CONTENT VERSUS SUCTION OF POROUS BODY: 2. THE BOUNDARY WETTING CURVE,**  
Tokyo Univ. (Japan).  
M. Nakano.  
Soil Science, Vol. 122, No. 2, p 100-106, August 1976. 9 fig, 1 tab, 9 ref.

Descriptors: \*Porosity, \*Moisture content, \*Wetting, \*Statistical models, Probability, Negative pore pressure, Curves, Drying, Boundaries (Surfaces), Saturation, Hysteresis, Porous media, Theoretical analysis, Surface tension, Sands, Laboratory tests, Distribution.  
Identifiers: Air entrapment, Density function, O-type pore, X-type pore.

The boundary wetting curve of water content versus suction was derived by using the effective pore volume distribution which is obtained by combination of probability theory with a pore model that was proposed in a previous report (Nakano 1976). The theoretical curve was compared to experimen-

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tal data with good agreement for three samples. But, when the theoretical boundary wetting curve was drawn by using the same values of parameters  $\lambda$ ,  $\mu$ , and  $\alpha$  as those applied to the boundary drying curve, a function which supplemented the relationship between suction and pore radius had to be used. This function was decided by measurement and was shown in the report. (Visocky-ISWS)  
W77-00162

**CATCHMENT MODELING AND INITIAL PARAMETER ESTIMATION FOR THE NATIONAL WEATHER SERVICE RIVER FORECAST SYSTEM,**  
National Weather Service, Washington, D.C. Office of Hydrology.  
For primary bibliographic entry see Field 2A.  
W77-00272

**RETENTION OF ARSENIC BY HYDROXY-ALUMINUM ON SURFACES OF MICACEOUS MINERAL COLLOIDS,**  
Saskatchewan Univ., Saskatoon. Dept. of Soil Science.  
For primary bibliographic entry see Field 5B.  
W77-00283

**SPATIAL VARIABILITY IN SOILS BELOW DEPTH OF TILLAGE: BULK DENSITY AND FIFTEEN ATMOSPHERE PERCENTAGE,**  
North Carolina State Univ., Raleigh. Dept. of Soil Science.  
D. K. Cassel, and A. Bauer.  
Soil Science Society of America, Vol. 39, No. 1, p 247-250, March-April, 1975. 5 fig, 3 tab, 5 ref.

Descriptors: \*Spatial distribution, \*Soil investigations, Soil properties, Soil texture, Bulk density, Soil water, Soil pressure, Clays, Loam.  
Identifiers: Tillage depth.

Soil bulk density (D) and the 15-atm percentage (FAP) were measured for three soils—Maddock sandy loam, Bearden silty clay, both of glaciolacustrine origin, and Heimdal silt loam of glacial origin. D and FAP were measured in approximately 30-cm increments from a depth of 30 to 152 cm. (Skogerboe-Colo St)  
W77-00284

**A PROCEDURE FOR THE SAMPLING AND TESTING OF LARGE SOIL CORES,**  
New South Wales Univ., Kensington (Australia). Dept. of Civil Engineering.  
K. K. Watson, and S. J. Lees.  
Soil Science Society of America Proceedings, Vol. 39, No. 3, p 589-590, May-June 1975. 1 fig, 6 ref.

Descriptors: \*Soil water, \*Computer models, Soil properties, Soil investigations, Soil moisture, Soil tests, \*Laboratory tests, \*Sampling, Soil analysis.  
Identifiers: \*Soil cores.

The significance of acquiring reliable data on the soil-water characteristics of field soils is discussed in relation to the input requirements of computer-based numerical models of the unsaturated flow process. A specification outlining the conditions to be fulfilled in sampling and testing a large soil core is then detailed. Equipment used in extracting a 40-cm-diam soil core is described together with relevant laboratory instrumentation. (Skogerboe-Colo St)  
W77-00286

**SOIL BULK DENSITIES AFTER THIRTY YEARS UNDER DIFFERENT MANAGEMENT REGIMES,**  
Grand Valley State Coll., Allendale, Mich. Dept. of Environmental Science.  
M. L. Northup, and J. R. Boyle.  
Soil Science Society of America Proceedings, Vol. 39, No. 3, p 588, May-June 1975. 1 tab.

Descriptors: \*Soil density, \*Bulk density, \*Nutrients, \*Cultivation, Soil properties, Soil investigations, Soils, Soil compaction, Vegetation.

Variability of soil bulk density must be known to convert accurately concentrations of nutrients in a soil to absolute quantities. This study shows that cultivation increases the bulk density of some soils and simultaneously lowers its variability. Establishment of prairie and pine vegetation on cultivated soils has not created significant differences in this property between vegetation types in 30 years. (Skogerboe-Colo St)  
W77-00287

**TWO-DIMENSIONAL SOLUTES TRANSFER DURING NONSTEADY INFILTRATION: LABORATORY TEST OF MATHEMATICAL MODEL,**  
Cornell Univ. Agricultural Experiment Station, Ithaca, N.Y. Dept. of Agronomy.  
E. Bresler, and D. Russo.  
Soil Science Society of America Proceedings, Vol. 39, No. 3, p 585-587, May-June 1975. 3 fig, 3 ref.

Descriptors: \*Solute, \*Infiltration, Irrigation, Irrigation effects, Irrigation practices, Soil water movement, \*Mathematical models, \*Laboratory tests.  
Identifiers: \*Trickle irrigation, \*Drip irrigation, \*Solute transport.

The theory of two-dimensional transport of solutes during nonsteady infiltration from trickle sources, as developed previously, was compared with experimental results. A laboratory experiment was conducted under conditions similar to those assumed in the two-dimensional plane flow model. The agreement between theory and experiment as expressed by salt concentration distribution and location of wetting fronts, is generally good. This suggests that the theory is applicable to many situations similar to the conditions studied. (Skogerboe-Colo St)  
W77-00288

**CHEMICAL WEATHERING OF GLAUCONITE,**  
Tripoli Univ., Libya. Dept. of Soil and Water Sciences.  
For primary bibliographic entry see Field 2K.  
W77-00289

**THE ACTIVITY CONCEPT OF PHOSPHATE-ROCK SOLUBILITY,**  
International Fertilizer Development Center, Florence, Ala.  
For primary bibliographic entry see Field 2K.  
W77-00290

**THE MECHANISM OF PHOSPHATE FIXATION BY IRON OXIDES,**  
Griffith Univ., Nathan, (Australia).  
For primary bibliographic entry see Field 2K.  
W77-00291

**VARIATIONS IN THE NATURAL ABUNDANCE OF N OF WHEAT PLANTS IN RELATION TO FERTILIZER NITROGEN APPLICATIONS,**  
Washington Univ., St. Louis, Mo. Center for the Biology of Natural Systems.  
For primary bibliographic entry see Field 3F.  
W77-00292

**EFFECT OF ANION EXCLUSION ON THE MOVEMENT OF CHLORIDE THROUGH SOILS,**  
Chile Univ., Santiago. Facultad de Ciencias Químicas.  
For primary bibliographic entry see Field 5B.  
W77-00293

**DENITRIFICATION RATES IN RELATION TO TOTAL AND EXTRACTABLE SOIL CARBON,**  
Agricultural Research Service, Beltsville, Md.  
G. Stanford, R. A. Vander Pol, and S. Dzienia.  
Soil Science Society of America Proceedings, Vol. 39, No. 2, p 284-289, March-April 1975. 2 fig, 5 tab, 16 ref.

Descriptors: \*Denitrification, \*Soil investigations, \*Soil chemistry, \*Soil chemical properties, \*Carbon.  
Identifiers: \*Soil carbon, Nitrate-nitrogen.

Denitrification rates were studied under near-anaerobic conditions in 30 soils of diverse origin that differed widely in pH, organic C contents, and other characteristics. Soils with added NO<sub>3</sub>-N were submerged in water and containers were sealed to prevent further oxygen intake during incubation. Disappearance of NO<sub>3</sub>-N and production of NH<sub>4</sub>-N were determined at 1-day intervals or longer over a 10-day period. Since soils were not shaken during incubation, denitrification rates were influenced by diffusion of nitrate from the liquid to the soil layer. In most soils, amounts of NO<sub>3</sub>-N declined exponentially with time of incubation. Thus, under the experimental conditions, the loss of nitrate was depicted better by log NO<sub>3</sub>-N vs. time (t, hours) than ppm NO<sub>3</sub>-N vs. t. (Skogerboe-Colo St)  
W77-00294

**SORPTION OF SULFUR DIOXIDE BY CALCAREOUS SOILS,**  
Arizona Univ., Tucson. Dept. of Soils, Water and Engineering.  
For primary bibliographic entry see Field 5B.  
W77-00295

**SODIUM AVAILABILITY IN NONALKALI SOILS,**  
Iowa State Univ., Ames. Dept. of Agronomy.  
A. Suarez-Hernandez, and J. J. Hanway.  
Soil Science Society of America Proceedings, Vol. 39, No. 2, p 308-311, March-April 1975. 2 fig, 2 tab, 17 ref.

Descriptors: \*Sodium, \*Soil investigations, \*Soil chemistry, \*Soil chemical properties, Soil management, \*Iowa.  
Identifiers: Exchangeable sodium, \*Ryegrass.

Ryegrass was grown in the greenhouse on undried soil samples from the 0 to 15 and 30 to 45 cm depths of 15 Iowa soils. The NH<sub>4</sub>OAc exchangeable Na was 21 ppm or less in all soil samples except those from the 30 to 45 cm depth in southern Iowa soils, which contained 28 to 115 ppm exchangeable Na. The pH of these southern Iowa subsurface samples varied from 5.1 to 6.0. Percentages of Na in the first harvest of ryegrass were directly related to the exchangeable Na contents of the soils and inversely related to exchangeable soil K and K content of the plants. (Skogerboe-Colo St)  
W77-00296

**TOTAL NITROGEN USING A SODIUM HYDROXIDE INDEX AND DOUBLE SAMPLING THEORY,**  
Forest Service (USDA), La Grande, Oreg. Pacific Northwest Forest and Range Experiment Station.  
J. M. Geist, and J. W. Hazard.  
Soil Science Society of America Proceedings, Vol. 39, No. 2, p 340-343, March-April 1975. 1 fig, 1 tab, 4 ref.

Descriptors: \*Nitrogen, \*Regression analysis, Soil chemistry, Soil properties, Soil investigations, Soil tests.  
Identifiers: \*Sodium hydroxide index, \*Double sampling theory.

A regression relationship was investigated between total Kjeldahl soil N and an NaOH distil-



## Field 2—WATER CYCLE

### Group 2G—Water In Soils

lable fraction of soil N. The correlation coefficient  $r$  was 0.989 for 45 soil samples. A double sampling approach using both analyses to estimate total N was more efficient than Kjeldahl analyses only. Example applications are presented under cost and precision limitations. The regression can also be used to obtain point values of total N for mapping or other nonstatistical purposes. (Skogerboe-Colo St)  
W77-00297

**RELATIONSHIPS BETWEEN SORPTION AND DESORPTION OF PHOSPHORUS BY SOILS.**  
International Inst. of Tropical Agriculture, Ibadan (Nigeria).  
For primary bibliographic entry see Field 5B.  
W77-00298

**A NEW TECHNIQUE FOR RAPID AND CONTINUOUS MEASUREMENT OF REDOX POTENTIALS.**  
Lockheed Missiles and Space Co., Sunnyvale, Calif.  
R. S. Lineberger, F. D. Whisler, and J. C. Lance.  
Soil Science Society of America Proceedings, Vol. 39, No. 2, p 375-377, March-April, 1975. 2 fig, 2 ref.

Descriptors: \*Laboratory tests, \*Electrodes, Soil tests, Sewage, Sewage disposal, \*Oxidation reduction potential, Measurement, Analytical techniques.  
Identifiers: Soil columns.

A new 'salt bridge' technique for the rapid and continuous measurement of redox potentials at various depths in multiple soil columns, utilizing only one calomel electrode, is described. The method was compared with a previous technique where a reference electrode was placed in each of 8 soil columns, containing a total of 42 platinum redox probes. A least-squares best fit statistical analysis indicated that the new technique yields redox potential measurements accurate as those of the previous method. Several other features of the salt bridge technique make it advantageous for use both in the laboratory and in the field. (Skogerboe-Colo St)  
W77-00299

**USE OF AMMONIA ELECTRODE FOR DETERMINATION OF CATION EXCHANGE CAPACITY IN SOIL STUDIES.**  
Iowa State Univ., Ames. Dept. of Soil Science.  
G. A. Miller, F. F. Riecken, and N. F. Walter.  
Soil Science Society of America Proceedings, Vol. 39, No. 2, p 372-373, March-April 1975. 1 fig, 7 ref.

Descriptors: \*Cation exchange, Soil tests, Soil properties, Soil investigations, Laboratory tests, Electrodes, Analytical techniques, \*Soil profiles, Ion exchange.  
Identifiers: Ammonia electrode.

Cation exchange capacity (CEC) was determined with an ammonia electrode on 37 horizon samples from four soil profiles. The profiles selected to test this procedure had a wide range of physical and chemical properties. The procedure was a modification of other techniques. Centrifugation was employed for removal of exchangeable cations and ammonium salts. The CEC values obtained with the ammonia electrode agreed closely with values obtained by direct distillation for adsorbed ammonia. The method was simple and rapid and suitable for soil studies. Using the proposed method a single operator could carry out the analysis of 16 or more samples in a normal working day. (Skogerboe-Colo St)  
W77-00300

**GRAPHICAL REPRESENTATION OF TRICATONIC EXCHANGES WHERE ONE OF THE CATIONS IS THE PROTON.**  
Centre de Recherches Agronomiques de Provence, Antibes (France). Station d'Agronomie et de Physiologie Vegetale.  
J. P. Andre.  
Journal of Soil Science, Vol. 26, No. 1, p 81-92, March 1975. 5 fig, 16 eq, 1 ref.

Descriptors: \*Model studies, \*Cation exchange, Soils, Soil investigations, Adsorption, Agronomy, Physiology.  
Identifiers: Protons(Cation exchange).

Most constituents of the adsorbing complex of the soil are cationic exchangers with variable exchange capacity: it is possible to study graphically exchanges involving the protons and two other cations. The representation developed here uses and generalizes the principle of the bicationic exchange isotherms in a square diagram. This helps to explain some experimental phenomena and enables the final equilibria of the exchange reactions to be forecast. The model seems useful for application in agronomy and physiology. (Skogerboe-Colo St)  
W77-00304

**EFFECT OF PLOUGHING AND DIRECT DRILLING ON SOIL NITRATE CONTENT.**  
Agricultural Research Council, Wantage (England). Letcombe Lab.  
R. J. Dowdell, and R. Q. Cannell.  
Journal of Soil Science, Vol. 26, No. 1, p 53-61, March 1975. 2 fig, 2 tab, 26 ref.

Descriptors: \*Nitrates, \*Cultivation, Soils, Soil investigations, Water quality, Clays.  
Identifiers: \*Soil nitrates, \*Cultivation practices, \*Direct drilling(Crops), \*Nitrate-nitrogen.

The concentration of nitrate-N at 30 cm depth in a clay soil was 2-5 times greater after ploughing than after direct drilling during the winter and spring of 1972-73. However, by early May no significant differences could be detected between cultivation treatments. It is concluded that decreased mineralization of soil nitrogen in the direct-drilled soil is the main factor responsible for the differences observed. (Skogerboe-Colo St)  
W77-00305

**EFFECT OF ALTERNATE AEROBIC AND ANAEROBIC CONDITIONS ON REDOX POTENTIAL, ORGANIC MATTER DECOMPOSITION AND NITROGEN LOSS IN A FLOODED SOIL.**  
Louisiana State Univ., Baton Rouge. Lab. of Flooded Soils and Sediments.  
For primary bibliographic entry see Field 5B.  
W77-00306

**TEMPERATURE EFFECTS ON AMMONIFICATION AND NITRIFICATION IN A TROPICAL SOIL.**  
Commonwealth Scientific and Industrial Organization, Canberra (Australia). Div. of Land Use Research.  
R. J. K. Myers.  
Soil Biology and Biochemistry, Vol. 7, No. 2, p 83-86, March 1975. 2 fig, 2 tab, 14 ref.

Descriptors: \*Ammonification, \*Nitrification, Soils, Soil investigations, \*Nitrogen, Temperature, Loans, \*Australia.  
Identifiers: \*Tropical soils, Organic nitrogen, \*Ammonium-nitrogen, Tippera clay loam.

Ammonification of soil organic N and nitrification of ammonium-N was studied in Tindall clay loam over a range of temperatures from 20-60 C. Nitrification rates at each temperature were constant throughout the 28 day incubation, whereas most of the ammonification occurred in the first 7 days. (Skogerboe-Colo St)

W77-00307

**FORMATION OF CHEMICAL AND BIOLOGICAL DENITRIFICATION PRODUCTS IN FLOODED SOIL AT CONTROLLED PH AND REDOX POTENTIAL.**  
Louisiana State Univ., Baton Rouge. Dept. of Agronomy.  
O. Van Cleemput, W. H. Patrick, Jr., and R. C. McIlhenny.  
Soil Biology and Biochemistry, Vol. 7, No. 4/5, p 329-332, July 1975. 3 fig, 1 tab, 13 ref.

Descriptors: \*Denitrification, \*Saturated soils, Soils, Soil investigations, Chemical reactions, \*Hydrogen ion concentration, \*Oxidation-reduction potential, Flooding, Saturated soils.

The formation of denitrification products was studied in a waterlogged soil which was treated with and without mercuric chloride. Before the addition of the sterilant and NO<sub>3</sub>-N the pH was controlled at 4.5, 6 and 8 and the redox potential at 0 and +400 mV in stirred suspensions. Denitrification products N<sub>2</sub>, N<sub>2</sub>O and some traces of NO were detected. (Skogerboe-Colo St)  
W77-00308

**SHORT TERM NITRATE LOSSES AND ASSOCIATED MICROBIAL POPULATIONS IN SOIL COLUMNS.**  
California Univ., Berkeley. Dept. of Soils and Plant Nutrition.  
H. E. Doner, M. G. Volz, L. W. Belser, and Jan-Per Loken.  
Soil Biology and Biochemistry, Vol. 7, No. 4/5, p 261-263, July 1975. 1 fig, 15 ref.

Descriptors: \*Nitrates, \*Leaching, Soil investigations, Soils, Soil tests, Return flow, Irrigation, Microbiology, Nitrogen.  
Identifiers: \*Soil columns, \*Microbial populations(Soils).

The relationship between NO<sub>3</sub> loss from solution and associated microbial populations as a function of time and depth in soil was studied. Soil columns were leached with a NO<sub>3</sub> solution under flooded conditions. Soil columns were cut into top, middle and bottom sections following 4.5, 12, 24, 48 and 120 h of leaching. Soil was subsequently analyzed for NO<sub>3</sub> and NO<sub>2</sub> content and microbial counts were made for denitrifiers, nitrate reducers and total microbial population. Nitrate losses were found to be directly related to an increase in the denitrifier population and proportional to the residence time of solution in the soil. The total microbial population and nitrate reducer population remained nearly constant throughout the experiment. (Skogerboe-Colo St)  
W77-00309

**SOIL ORGANIC MATTER FRACTIONS AS SOURCES OF PLANT AVAILABLE SULPHUR.**  
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Plant Industry.  
J. R. Freney, G. E. Melville, and C. H. Williams.  
Soil Biology and Biochemistry, Vol. 7, No. 3, p 217-221, May 1975. 1 fig, 5 tab, 21 ref.

Descriptors: \*Organic matter, \*Sulphur, Soils, Soil investigations, Soil-water-plant relationships.  
Identifiers: Soil organic matter.

Pot culture experiments are described which attempt to identify the organic fractions of soil sulphur that decompose during the growing season to provide plant-available sulphur. Soil organic matter was labelled with <sup>35</sup>S by incubating soil with labelled sulphate and several organic sulphur fractions were determined before and after the growth of *Sorghum vulgare* and following a fallow treatment. The effect of moisture stress on the uptake of sulphur by plants was also investigated;

## WATER CYCLE—Field 2

### Water In Soils—Group 2G

this treatment had little effect. (Skogerboe-Colo St)  
W77-00310

**RELATIONSHIPS BETWEEN THE DENITRIFICATION CAPACITIES OF SOILS AND TOTAL, WATER-SOLUBLE AND READILY DECOMPOSABLE SOIL ORGANIC MATTER.**  
Iowa State Univ., Ames. Dept. of Agronomy. J. R. Burford, and J. M. Bremner.  
Soil Biology and Biochemistry, Vol. 7, No. 6, p 389-394, November 1975. 5 fig, 3 tab, 13 ref.

Descriptors: Organic matter, \*Denitrification, Soils, Soil investigation, Soil chemistry, \*Nitrogen, Anaerobic conditions, \*Decomposing organic matter, Carbon.  
Identifiers: Organic carbon.

The relationships between the denitrification capacities of 17 surface soils and the amounts of total organic carbon, mineralizable carbon, and water-soluble organic carbon in these soils were investigated. The soils differed markedly in pH, texture, and organic-matter content. Denitrification capacity was assessed by determining the N evolved as N<sub>2</sub> and N<sub>2</sub>O on anaerobic incubation of nitrate-treated soil at 20 degrees C for 7 days, and mineralizable carbon was assessed by determining the C evolved as CO<sub>2</sub> on aerobic incubation of soil at 20 degrees C for 7 days. The denitrification capacities of the soils studied were significantly correlated with total organic carbon and very highly correlated with water-soluble organic carbon or mineralizable carbon. The amount of nitrate N lost on anaerobic incubation of nitrate-treated soils for 7 days was very closely related to the amount of N evolved as N<sub>2</sub> and N<sub>2</sub>O. (Skogerboe-Colo St)  
W77-00311

**PERFORMANCE AND EVALUATION OF COMBINED MOLE-TILE DRAIN SYSTEM IN HEAVY SOILS.**  
Utah State Univ., Logan.  
For primary bibliographic entry see Field 4A.  
W77-00316

**AN EXPERIMENTAL BURIED MULTISET IRRIGATION SYSTEM.**  
Agricultural Research Service, Kimberly Idaho. Snake River Conservation Research Center.  
For primary bibliographic entry see Field 3F.  
W77-00317

**NITROGEN IN SOIL CORES AND GROUND WATER UNDER ABANDONED CATTLE FEEDLOTS.**  
Agricultural Research Service, Lincoln, Nebr. Animal Waste Management Research Unit.  
For primary bibliographic entry see Field 5B.  
W77-00365

**MAPPING RUNOFF-PRODUCING ZONES IN HUMID REGIONS.**  
McGill Univ., Montreal (Quebec). Dept. of Geography.  
For primary bibliographic entry see Field 4A.  
W77-00368

**FACTORS AFFECTING SPRING RUNOFF ON TWO FORESTED WATERSHEDS.**  
Forest Service (USDA), Flagstaff, Ariz. Rocky Mountain Forest and Range Experiment Station.  
For primary bibliographic entry see Field 2E.  
W77-00374

**TRANSPORT OF CARBON14-ASSIMILATES IN THE SUGAR BEET UNDER DIFFERENT CONDITIONS OF NUTRITION AND MOISTURE, (IN RUSSIAN).**  
Kirgiz State Univ., Frunze (USSR).

For primary bibliographic entry see Field 5B.  
W77-00421

**ESTIMATION AND SIMULATION OF SHEET RUNOFF.**  
Commonwealth Scientific and Industrial Organization, Canberra (Australia). Div. of Land Use Research.  
For primary bibliographic entry see Field 4A.  
W77-00439

**THE EFFECT OF BULK DENSITY ON NEUTRON METER CALIBRATION.**  
Commonwealth Scientific and Industrial Research Organization, Glen Osmond, (Australia). Div. of Soils.  
E. L. Greacen, and G. Schrale.  
Australian Journal of Soil Research, Vol 14, No 2, p 159-169, June 1976. 2 fig, 4 tab, 10 ref.

Descriptors: \*Nuclear moisture meters, \*Calibrations, \*Soil density, Soil moisture, Moisture content, Instrumentation, Measurement, Neutron absorption, Soil physical properties.

In the use of neutron moisture meters sufficient account is not always taken of the need for careful calibration, particularly with respect to variations in soil dry bulk density. Experimental and theoretical methods have been proposed for obtaining correction factors but for various reasons they are not satisfactory. Olgaards method based on three group diffusion theory gives acceptable accuracy for soils with small absorption cross-section, but for soils with high absorption cross-section, common in Australia, this model fails to predict the slope of the calibration line. A simpler alternative procedure is proposed, based on the assumption that count rate at constant total water content is proportional to the square root of bulk density. (CSIRO)  
W77-00440

**HYDRAULIC CONDUCTIVITY IN SURFACE ACTIVE SOILS.**  
Punjab Agricultural Univ., Ludhiana (India). Dept. of Civil Engineering.  
P. Basak, and M. R. Madhav.  
Australian Journal of Soil Research, Vol. 14, No. 2, p 121-127, June 1976. 4 fig., 16 ref.

Descriptors: \*Clays, \*Hydraulic conductivity, \*Pore water, \*Water structure, \*Viscosity, \*Bound water, Capillary water, Capillary flow, Soil water movement, Soil physical properties, Equations, Mathematical studies.

Kozeny's equation based on a capillary tube model with constant viscosity does not give satisfactory results for fine-grained soils. When surface forces dominate over gravity forces, the pore water behaves abnormally and the physical properties of this pore water are found to be quite different from free water. Flow through saturated fine-grained soils is known to be affected by the properties and thickness of loosely and strongly bound water, whose viscosity is observed to be higher because of the modified water structure induced by clay-water interaction. An analytical solution based on a capillary-tube model taking into account the changed viscosity of bound water and variation of viscosity within the bound water in relation to its thickness is attempted. The derived equation appears to be general in nature and is applicable for both surface active and inactive soils. It is shown that Kozeny's equation turns out to be a particular case of the derived equation when the thickness of the bound water is zero or when the variation of viscosity is not taken into account. (CSIRO)  
W77-00441

**A WATER BALANCE MODEL AND SUPPLY INDEX FOR WHEAT IN SOUTH AUSTRALIA.**  
Commonwealth Scientific and Industrial Research Organization, Adelaide (Australia). Div. of Soils.  
For primary bibliographic entry see Field 3F.  
W77-00444

**THE EFFECT OF SOIL PROPERTIES ON ZINC ADSORPTION BY SOILS.**  
Georgia Univ., Experiment. Dept. of Agronomy. L. M. Shuman.  
Soil Science Society of America Proceedings, Vol. 39, No. 3, p 454-458 May-June, 1975. 4 fig, 2 tab, 18 ref.

Descriptors: \*Zinc, \*Organic matter, \*Clays, Soils, \*Soil investigations, \*Sands, Soil chemistry, Soil texture, \*Adsorption, Georgia, Hydrogen ion concentration, Organic matter, Isotherms, Cation exchange, Path of pollutants.  
Identifiers: Langmuir isotherm, \*Cation exchange capacity.

Solutions containing eight different concentrations of Zn were equilibrated with four soils sampled at two depths to determine whether Zn adsorption conformed to the Langmuir isotherm and to relate the Langmuir coefficients to soil properties. Zinc adsorption conformed to the Langmuir isotherm and two linear portions of the curve were found. The adsorption sites for the lower part had very high bonding energy coefficients and low adsorptive capacities compared with the adsorption sites of the part of the curve corresponding to higher Zn concentrations in the equilibrating solution. The cation exchange capacity (CEC) was related to the adsorptive capacity. The lower part was equivalent to 23% of the CEC and the upper part to 76% of the CEC. Soils high in clay or organic matter had higher adsorptive capacities and higher bonding energies for Zn than sandy soils low in organic matter. More differences in Zn adsorption were observed among soil types than between depths in each soil type. A study of the effect of pH on the adsorption of Zn revealed that low pH reduced Zn adsorption more for the sandy soils than for those high in colloidal-size materials. (Skogerboe-Colo St)  
W77-00469

**INTERACTIONS BETWEEN ORGANIC COMPOUNDS, MINERALS, AND IONS IN VOLCANIC ASH DERIVED SOILS: I. ADSORPTION OF BENZOATE, P-OH BENZOATE, SALICYLATE, AND PHTHALATE IONS.**  
California Univ., Riverside. Dept. of Soil Science. H. Appelt, N. T. Coleman, and P. F. Pratt.  
Soil Science Society of America Proceedings, Vol. 39, No. 4, p 623-627, July-August 1975. 4 fig, 4 tab, 15 ref.

Descriptors: \*Ions, \*Organic compounds, \*Adsorption, Soils, \*Soil investigations, Path of pollutants, South America, Soil analysis.  
Identifiers: \*Desorption, \*Minerals, Benzoate ions, Salicylate ions, Phthalate ions, \*Chile, \*Typic Dystrandept soils, \*Volcanic-ash soils.

The adsorption, desorption, and competitive adsorption characteristics of benzoate, p-OH benzoate, salicylate, and phthalate were used as models to study the possible mechanisms involved in the interactions of organic compounds with amorphous materials. The studies were carried out in batch systems using subsoil samples of three Typic Dystrandept soils from Chile. (See also W77-00474) (Skogerboe-Colo St)  
W77-00473

**INTERACTIONS BETWEEN ORGANIC COMPOUNDS, MINERALS, AND IONS IN VOLCANIC-ASH-DERIVED SOILS: II. EFFECTS OF ORGANIC COMPOUNDS ON THE ADSORPTION OF PHOSPHATE.**  
California Univ., Riverside. Dept. of Soil Science. H. Appelt, N. T. Coleman, and P. F. Pratt.

## Field 2—WATER CYCLE

### Group 2G—Water In Soils

Soil Science Society of America Proceedings, Vol. 39, No 4, p 628-630, July-August 1975. 5 tab, 16 ref.

Descriptors: \*Organic compounds, \*Ions, \*Adsorption, \*Phosphates, Soils, \*Soil investigations, Path of pollutants, South America, Anions, Soil analysis.  
Identifiers: \*Minerals, \*Chile, \*Typic Dystrandept soils, \*Volcanic-ash soils.

The effects of organic compounds on phosphate adsorption by volcanic-ash-derived soils were studied using benzoate, p-OH benzoate, salicylate, and phthalate, and by humic and fulvic acids extracted from a surface soil sample of a Typic Dystrandept. The adsorption of simple organic anions that are specifically adsorbed block to some extent the adsorption sites for nonspecifically adsorbed anions such as chloride and/or nitrate. But, organic anions did not compete for or block adsorption sites for phosphate anions, because of the much higher affinity of phosphates for the adsorption sites in these volcanic-ash-derived soils. (See also W77-00473) (Skogerboe-Colo St) W77-00474

**EFFECT OF AGRICULTURAL DRAINAGE ON WATER QUALITY.**  
Virginia Polytechnic Inst. and State Univ., Blacksburg. Southern Piedmont Center.  
For primary bibliographic entry see Field 5B. W77-00475

**VARIATIONS IN PICLORAM LEACHING PATTERNS FOR SEVERAL SOILS.**  
Washington State Univ., Pullman. Dept. of Agronomy and Soils.  
C. L. Ping, H. H. Cheng, and B. L. McNeal.  
Soil Science Society of America Proceedings, Vol. 39, No. 3, p 470-473, May-June 1975. 3 fig, 2 tab, 9 ref.

Descriptors: \*Leaching, Soils, \*Soil investigations, \*Soil texture, Pesticides, \*Diffusion, \*Saturated soils, Diffusivity, Porosity, \*Hawaii, Electron microscopy, Path of pollutants.  
Identifiers: \*Picloram, Volcanic soils(Hawaii).

Laboratory studies of picloram leaching under saturated conditions were conducted for four soils. Leaching patterns could be related to variations in soil texture and pore uniformity for three soils from arid and semiarid regions. Diffusion from conducting pores into adjacent micropores appeared to be the most plausible explanation of leaching patterns obtained for an Oxisol of volcanic origin from Hawaii. Evidence supporting the presence of the postulated micropore structure in this tropical soil was obtained from constancy in flow rate, from scanning electron micrographs, and from picloram recovery at a reduced leaching rate. (Skogerboe-Colo St) W77-00476

**NITRATE REDUCTION AND NITRITE UTILIZATION BY NITRIFIERS IN AN UNSATURATED HANFORD SANDY LOAM.**  
California Univ., Berkeley. Dept. of Soils and Plant Nutrition.  
For primary bibliographic entry see Field 5B. W77-00478

**THE MINERAL CONTENT IN SOIL AND SUBSOIL WATER CLOSE TO THE SURFACE BELOW CONIFEROUS AND ARABLE LAND IN SANDY SOIL OF NORTHWEST GERMANY, (IN GERMAN).**  
Landwirtschaftskammer Weser-Ems, Oldenburg (West Germany).  
P. Foerster.  
Forstwiss Centralbl. 94(2/3), p 67-78, 1975.

Descriptors: \*Sampling, \*Subsurface waters, \*Soil water, Land, Arable land, Coniferous forests, \*Mineral water, Mineralogy, Chlorine, Nitrogen, Phosphorus, Sulfur, Hydrogen ion concentration.  
Identifiers: \*Mineral content, \*West Germany.

Samples of water were extracted during Feb. 1973-Jan. 1974, and tested for N03-N, NH4-N, N02-N, total P, S04-S, C1 and pH. From the depths (30-60 cm, 60-90 cm, 110-140 cm, 150-180 cm below the surface) the water was obtained by the Czeratzki suction apparatus. The subsoil water from the lowest depths (180-210 cm below the surface) was extracted by upright tubes. The N03-N content in soil and subsoil water below woodland was very little in comparison with fertilized arable land. Accordingly, the exudates of N03-N below woodland were approximately 10 times less in comparison with those of arable land. The NH4-N, N02-N and P content in soil water and subsoil water close to the surface below woodland and arable land was approximately the same. Below woodland the S04-S content in soil water was greater than that in arable land, whereas in subsoil water the S04-S content was the same. The C1 content of subsoil water close to the surface below arable land was twice as much as that below woodland.—Copyright 1976, Biological Abstracts, Inc. W77-00493

**WATER PERMEABILITY OF DARK-CHESTNUT SOILS OF THE KUSTANAI OBLAST, (IN RUSSIAN).**  
A. A. Naumenko.  
Izv Akad Nauk Kaz SSR Ser Biol. 13(1), p 58-60, 1975.

Descriptors: \*Chestnut soil \*Permeability, \*Soil water movement, \*Cultivated lands, Arable land.  
Identifiers: Kustanai oblast (USSR).

During June-Aug. water permeability on virgin land increases and on plowed areas it decreases, sometimes considerably. Permeability was maximum when spring wheat was sown on a plowed field, and minimum on virgin land. There was a marked decrease of water permeability at the end of summer on old arable fallow land.—Copyright 1975, Biological Abstracts, Inc. W77-00501

**LIGHT-CHESTNUT LONG-IRRIGATED SOIL OF THE SHARUR PLAIN, (IN RUSSIAN).**  
Z. R. Bairamov.  
Izv Akad Nauk Az SSR Ser Biol Nauk. 4, p 59-62, 1974.

Descriptors: Soils, Brown soils, \*Chestnut soils, \*Grasslands, \*Irrigation effects, Soil profiles.  
Identifiers: Chemical, Chestnut, Composition, Description, Irrigated, Light, Long, Morphology, Sharur plain, \*Azerbaijan, \*USSR.

These dry steppe soils in the Azerbaijan SSR (USSR) changed their morphological appearance under the effect of prolonged irrigation and are characterized by the presence of irrigation-borne sediments, depth of the humus profile, formation of an illuvial horizon, accumulation of a silt fraction in the middle part of the profile and sometimes the formation of an indurated horizon. Data are given on the main physicochemical indices and chemical composition of the soils.—Copyright 1975, Biological Abstracts, Inc. W77-00510

**ORIGIN AND USE OF RUDYAK SOILS, FERRUGINOUS SOLONCHAKS OF THE TAIGA ZONE, (IN RUSSIAN).**  
Moscow State Univ. (USSR). Dept. of Soil Physics and Reclamation.  
F. R. Zaidel'man, and R. P. Narokova.  
Biol Nauki. 17(12), p 106-112, 1974.

Descriptors: Soils, Clays, Swamps, \*Forest soils, Drainage systems, Agricultural engineering.  
Identifiers: \*Ferruginous solonchak, Jurassic clays, \*Rudyak soils, \*Solonchaks, \*Taiga, \*USSR.

Problems of the origin and use of rudyak soils (ferruginous solonchaks of the taiga zone) are discussed. These soils are formed in areas swamped by highly ferruginous groundwaters. Ferruginization of the waters and soils is due to the geologic structure of the territory, particularly the relatively close occurrence of Jurassic clays. Ways of evaluating the expediency of constructing drainage systems and agricultural development of swamped soils with rudyak horizons are given.—Copyright 1975, Biological Abstracts, Inc. W77-00511

**INFLUENCE OF AN INSERTED ASPHALT LAYER ON THE PLANT YIELD ON A LIGHT SOIL, (IN POLISH).**  
Instytut Uprawni Nowozemia i Gleboznactwa, Laskowice Olawskie (Poland). Zaklad Uprawni Rol.  
For primary bibliographic entry see Field 3F. W77-00513

**THE CHANGE OF CLAY MATERIAL IN CHERNOZEMS UNDER RICE CULTIVATION, (IN RUSSIAN).**  
Moscow State Univ. (USSR). Dept. of Soil Science.  
G. M. Mainasheva, N. P. Chizhikova, and S. A. Nikolaeva.  
Vestn Mosk Univ Ser 6 Biol Pochvoved. 29(6), p 74-80, 1974.

Descriptors: \*Clays, \*Rice, \*Aquatic soils, Drowned(Submerged), \*Submergence, Flooding, \*Oxidation-reduction potential, \*Soil chemical properties, Chemical properties, \*Chernozems, Oxidation-reduction potential.  
Identifiers: Montmorillonite, Shamoite, USSR.

The influence of periodic inundation under a rice crop was studied in the southern chernozems of Odessa oblast (Ukrainian SSR, USSR). The dynamics of several elements and the change in the chemico-mineralogical composition of the clay material were determined in the field cultivated with rice for 4 yr. Due to inundation the upper horizons lost their < 0.001 mm particles and their montmorillonite component. There is a possibility of the formation of the shamoite type of mineral with an imperfect structure due to the change in redox potentials of the soil.—Copyright 1975, Biological Abstracts, Inc. W77-00523

**MECHANISM OF INTERACTION OF WEAKLY MINERALIZED IRRIGATION WATER WITH SOIL, (IN RUSSIAN).**  
Moscow State Univ. (USSR). Dept. of Soil Science.  
B. G. Rozanov, and M. A. Abdel' Mottalib.  
Biol Nauki. 18(2), p 127-130, 1975.

Descriptors: \*Irrigation effects, \*Soils, \*Soil chemical properties, \*Surface-groundwater relationships, Sodium, Potassium, Calcium, Magnesium, Mineral water.

When the irrigation and ground waters interact with the soil their composition changes considerably; the change in the composition of Na and K salts was a result of evaporation of the water, and that of Ca and Mg salts was a result of the interaction with the solid phase of the soils.—Copyright 1975, Biological Abstracts, Inc. W77-00524



## 2H. Lakes

**CAUSES AND ALTERNATIVE SOLUTIONS TO THE WATER QUALITY PROBLEMS OF BIG STONE LAKE, WESTERN MINNESOTA-NORTHEASTERN SOUTH DAKOTA.**  
Midwest Research Inst., Kansas City, Mo.  
For primary bibliographic entry see Field 5C.  
W77-00047

**A PHOSPHORUS RESIDENCE TIME MODEL: THEORY AND APPLICATION.**  
Texas Univ. at Dallas, Richardson. Inst. for Environmental Sciences.  
For primary bibliographic entry see Field 5B.  
W77-00124

**VOLATILE FATTY ACIDS IN BOTTOM DEPOSITS OF THE RYBINSK RESERVOIR, (IN RUSSIAN).**  
Akademiya Nauk SSSR, Moscow. Institut Biologii Vnutrennykh Vod.  
For primary bibliographic entry see Field 5C.  
W77-00126

**A SIMPLE METHOD FOR DETERMINING THE EVAPORATION FROM SHALLOW LAKES AND PONDS.**  
Atmospheric Environment Service, Downsview (Ontario).  
For primary bibliographic entry see Field 2D.  
W77-00127

**ROLE OF EDDY DIFFUSIVITY IN THERMOCLINE FORMATION.**  
Leicester Univ. (England). Dept. of Engineering. B. Henderson-Sellers.  
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol. 102, No. EE3, Proceedings Paper 12174, p 517-531, June 1976. 8 fig, 3 tab, 19 ref, 2 append.

Descriptors: \*Eddies, \*Model studies, \*Environmental engineering, \*Diffusion, Heat transfer, Hydrodynamics, Mixing, Reservoirs, Stratification, Temperature, \*Thermocline, Lakes, Turbulence, Water quality, Stratified flow, Stability, Equations.  
Identifiers: \*Eddy diffusivity, Stratified lake, Thermocline structure, Neutral eddy diffusion.

Several functional forms for the eddy diffusivity in a lake or reservoir were analyzed for incorporation into a one-dimensional model for the vertical temperature structure of the water body. A suitable form for the neutral eddy diffusivity was found, and this was used in solution of the heat transfer equation to simulate thermocline formation and seasonal development. (Lee-ISWS)  
W77-00139

**CHANGE OF BENTHIC COMPLEXES UNDER THE EFFECT OF OVERGROWTH IN EUTROPHIC LAKE BALTIC, (IN RUSSIAN).**  
For primary bibliographic entry see Field 5C.  
W77-00140

**PRESENT STATE OF ZOOPLANKTON AND ZOOBENTHOS OF LAKE ADZHİKABUL, (IN RUSSIAN).**  
A. G. Kasymov, F. G. Badavov, and A. R. Aliev. Izv Akad Nauk Az Ssr Ser Biol Nauk 2, p 107-110, 1975.

Descriptors: Zooplankton, Benthos, Copepoda, Salinity, Regime, Oxygen, Lakes, Rotifers.  
Identifiers: \*Lake Adzhikabul(USSR), Azerbaijan-Ssr, USSR.

Lake Adzhikabul (area 860 ha, length 6 km, width 3 km, depth 5 m) is located on the left bank of the

Kura River in the Azerbaijan SSR (USSR). After construction of the Mingechaur hydroelectric station the lake ceased to obtain water from the Kura and began to dry up and become salty. Formerly there were 45 spp. of zooplankton, now there are 6 spp. of rotifers and 2 spp. of copepods, all salt-loving or resistant to increased salinity. The number of species of benthos has decreased from 44 to 10 in connection with the deterioration of the O<sub>2</sub> regime and salinization of the water. Measures for improving the abiotic and biotic environment of the lake are recommended.—Copyright 1976, Biological Abstracts, Inc.  
W77-00142

**NUMBER, GENERATION TIME AND PRODUCTION OF BACTERIA IN WATER OF THE SARATOV RESERVOIR, (IN RUSSIAN).**  
Akademiya Nauk SSSR, Moscow. Institut Biologii Vnutrennykh Vod.  
For primary bibliographic entry see Field 5C.  
W77-00143

**PILOT INVESTIGATION OF THE IMPORTANCE OF VARIOUS WETLAND TYPES TO DUCK PRODUCTION.**  
South Dakota State Univ., Brookings. Dept. of Wildlife and Fisheries.  
J. M. Gates, and L. D. Flake.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-258 780, Price codes: A03 in paper copy, A01 in microfiche. Completion Report, July 1976. 32 p, 1 fig, 22 ref. OWRP A-038-SDAK(1). 14-31-0001-4042

Descriptors: \*Wetlands, \*Waterfowl, Reproduction, \*Ducks, Water resources development, Wildlife conservation, Balance of nature, Habitat improvement, \*South Dakota, Mallard ducks, Gadwall ducks, Blue-winged teal, Pintail duck.  
Identifiers: Waterfowl production.

Wetland characteristics, adjacent upland conditions, and corresponding populations of breeding waterfowl broods were surveyed on 500 quarter sections in 125 clusters proportionally stratified within eight physiographic strata in South Dakota. The estimated total of breeding pairs was 1,067,500 in 1973 and 439,600 in 1974. Drought conditions occurred concurrent with the reduced 1974 populations. Blue-winged teal (*Anas discors*) was the major species followed by mallard (*Anas platyrhynchos*), pintail (*Anas acuta*), and gadwall (*Anas strepera*). Less than five percent of the total breeding pairs was composed of diving ducks (*Aythya*). Striking differences in densities of breeding pairs occurred between the major physiographic regions of the state. Waterfowl densities were highest in the glaciated eastern half of South Dakota, particularly in the northern periphery of the Coteau des Prairies and the major portion of the Coteau du Missouri. The non-glaciated western half of the state had relatively low waterfowl densities but contributed 21.6 percent in 1973 and 32.3 percent in 1974 of the total breeding pairs. Class III and IV ponds and stockdams were used by a large segment of most waterfowl populations throughout the study. Stockdams were used by a larger segment of all populations in 1974 than in 1973, while the proportion of ducks using natural ponds and lakes decreased from 1973 and 1974. Dugouts closely associated with other wetlands had higher waterfowl use than those not associated with other wetlands. (Wiersma-South Dakota)  
W77-00145

**A FOUR-YEAR ANALYSIS OF VEGETATION FOLLOWING AN OIL SPILL IN A FRESH-WATER MARSH.**  
Smith Coll., Northampton, Mass. Dept. of Biological Sciences.  
For primary bibliographic entry see Field 5C.  
W77-00147

**INVESTIGATION OF BACTERIOLOGICAL POLLUTION OF RECREATIONAL WATERS IN ARIZONA.**  
Arizona Univ., Tucson. Dept. of Watershed Management; and Arizona Univ., Tucson. School of Renewable Natural Resources.  
For primary bibliographic entry see Field 5B.  
W77-00153

**ISOLATION AND IDENTIFICATION OF BLUE-GREEN ALGAE PRODUCING MUDDY ODOR METABOLITES, GEOSMIN, AND 2-METHYLISOBORNEOL, IN SALINE LAKES IN MANITOBA.**  
Fisheries and Marine Service, Winnipeg (Manitoba). Freshwater Inst.  
For primary bibliographic entry see Field 5A.  
W77-00185

**ALGAL PRODUCTIVITY IN 49 LAKE WATERS AS DETERMINED BY ALGAL ASSAYS.**  
Pacific Northwest Environmental Research Lab., Corvallis, Oreg.  
For primary bibliographic entry see Field 5C.  
W77-00187

**LAKE CHAMPLAIN: A CASE HISTORY ON THE CLEANUP OF NO. 6 FUEL THROUGH FIVE FEET OF SOLID ICE AT NEAR-ZERO TEMPERATURES.**  
Environmental Protection Agency, Edison, N. J. Region II.  
For primary bibliographic entry see Field 5G.  
W77-00257

**EVALUATION OF TECHNIQUES FOR LONG-RANGE FORECASTING OF AIR TEMPERATURE AND ICE FORMATION.**  
National Oceanic and Atmospheric Administration, Ann Arbor, Mich. Great Lakes Environmental Research Lab.  
For primary bibliographic entry see Field 2C.  
W77-00275

**LONG-RANGE FORECASTING OF MAXIMUM ICE EXTENT ON THE GREAT LAKES.**  
National Oceanic and Atmospheric Administration, Ann Arbor, Mich. Great Lakes Environmental Research Lab.  
For primary bibliographic entry see Field 2C.  
W77-00276

**LITTORAL ZOOPLANKTON OF THE BAIKAL OPEN ZONE, (IN RUSSIAN).**  
Limnologicheskii Institut, Irkutsk (USSR). E. L. Afanas'eva.  
Gidrobiol Zh 11(3), p 26-31, 1975.

Descriptors: \*Zooplankton, \*Littoral, Lakes, Crustaceans, Rotifers.  
Identifiers: Cyclopidae, \*Epischura, USSR, \*Lake Baikal(USSR).

Zooplankton of the Baikal (USSR) littoral zone, a narrow shelf area without large inflows and bays is under the constant influence of the waters of the open zone of the lake. A dominating form here is the Baikal endemic *Epischura*. Periods of appearance and development of Cyclopidae, Cladocera and lake rotifers coincide with those in the open zone, with a predominance of these forms in the littoral. Sharp changes in zooplankton number are observed at constant stations with daily sampling, caused by a spotty distribution of zooplankton and the dynamics of water masses in this region.—Copyright 1976, Biological Abstracts, Inc.  
W77-00333

## Field 2—WATER CYCLE

### Group 2H—Lakes

**ON THE EUTROPHICATION IN THE LAKE CHANGJA, (IN KOREAN),** Seoul National Univ. (Republic of Korea). Dept. of Botany.  
For primary bibliographic entry see Field 5C.  
W77-00344

**APPENDIX 4, LIMNOLOGY OF LAKES AND EMBAYMENTS, GREAT LAKES BASIN FRAMEWORK STUDY.** Great Lakes Basin Commission, Ann Arbor, Mich. Public Information Office.  
1976. 441 p, 301 fig, 95 tab, 923 ref.

Descriptors: \*Great Lakes Region, \*Lake Erie, \*Lake Huron, \*Lake Michigan, \*Lake Ontario, \*Lake Superior, \*Geomorphology, Physical properties, \*Limnology, \*Climatology, Hydrology, Chemical properties, Biological properties, \*Sedimentology, Water utilization, Great Lakes, Lakes, \*Bays, Precipitation(Atmospheric), Evaporation, Water levels, Water temperature, Radiation, Water level fluctuations, Ice cover, Iced lakes, Currents(Water), Density currents, Water circulation, Trace elements, Bacteria, Coliforms, Data collections, Bottom sediments, Sediment distribution, Ice, Meteorology.  
Identifiers: Upland lakes.

This appendix presented the processes that underlie the hydrology, hydrodynamics, biology, and chemistry of the Great Lakes, harbors, embayments, and upland lakes in the Great Lakes Basin; also, current knowledge of the limnological processes was synthesized. The appendix also aids the development of a comprehensive plan for optimum utilization of water and related land areas by doing the following: (1) synthesizing the limnological data applicable to regional planning considerations; (2) describing the limnological processes of the Great Lakes and of the upland lakes of the Great Lakes Basin in such a fashion that they may be logically interrelated; (3) identifying those regions in which insufficient data exist for water resource planning and defining the data deficiencies; (4) identifying those physical, chemical, and biological processes that are inadequately understood and require further study; (5) defining those Great Lakes water resource problems that exist or that may arise by the year 2020; and (6) serving as a basic data source use and management appendices. The data used in this report were obtained from material either in print or readily accessible from local, State, and Federal agencies. (See also W76-03862 through W76-03870) (Humphreys-ISWS)  
W77-00358

**POSSIBILITIES OF DETERMINING COMMUNITY BOUNDARIES WITHIN THE LIMITS OF A LAKE ECOSYSTEM, (IN RUSSIAN),** Nature Conservation, Game Preserves and Hunting, Moscow (USSR). Central Lab.  
N. V. Vehov.  
Zh Obshch Biol 36(3), p 382-388, 1975.

Descriptors: Lakes, \*Ecosystems, \*Zooplankton, \*Littoral, Depth, Biomass, \*Biological communities.  
Identifiers: \*Pelagial depth, \*Lake Yaneity(USSR).

The zooplankton of Lake Yaneity (Bolshezemskaya Tundra) (USSR) were used to study the possibility of establishing the spatial limits of the littoral (depths to 1.5 m) and pelagial (depths to 4-6.5 m) zooplankton communities. The species composition of zooplankton was similar in both biotopes, but the species exhibited population density peaks at different times in the littoral and pelagial, their population density also being different. The highest abundance and maximum biomass were observed in different periods; the ratios of the principal taxa and trophic groups in the plankton were different in the course of the observation periods changes in the ratio of these

groups occur within the limits of each biotope. The species diversity and biomass was characteristic in the littoral, but it was positive for the pelagial. Such regularities were not detected for all the points throughout the lake when estimating the correlations. This lake contains 2 different plankton communities inhabiting different natural areas of the lake and having many discriminating features, though their species composition may be identical.—Copyright 1976, Biological Abstracts, Inc.  
W77-00367

**EVENTS IN THE DJERDAP RESERVOIR IMMEDIATELY AFTER IMPOUNDMENT, (IN GERMAN),** Institute for Biological Research, Belgrade (Yugoslavia).  
G. Petrovic.  
Arch Hydrobiol Supplementb. 44(4), p 383-391, 1975.

Descriptors: \*Reservoirs, \*Impoundments, \*Rivers, Chemical reactions, \*Physicochemical properties, \*Post-impoundment.  
Identifiers: \*Djerdap Reservoir, \*Yugoslavia, \*Danube River.

The analyses of the changes in space and time occurring in the recently impounded reservoir of Djerdap, contribute to a better understanding of the physical-chemical changes which occurred in that sector of the Danube (Yugoslavia).—Copyright 1976, Biological Abstracts, Inc.  
W77-00409

**ZOOPLANKTON OF THE AKSTAF RESERVOIR, (IN RUSSIAN),** N. B. Talybov.  
Izv Akad Nauk Az SSR Ser Biol Nauk. 1, p 85-88, 1975.

Descriptors: Reservoirs, \*Zooplankton, Plankton, \*Sampling, Rivers, Biomass, Water sampling.  
Identifiers: \*Akstafa Reservoir, Asplanchna-Priodonta, Azerbaijan SSR, Bosmina-Longirostris, Brachionus-Rubens, Cyclops-Strenuus, Daphnia-Longispina, Dunhevedi-Crassa, Eucyclops-Serrulatus, Lecane-Bulla, Moira-Rectirostris, \*USSR.

An investigation of water samples taken from the Akstafa reservoir (area 630 ha), constructed in 1969 on the Akstafachai River near the city of Kazkh in the Azerbaijan SSR (USSR), revealed 24 spp. of zooplankton (9 spp. of Rotatoria, 11 Cladocera and 4 Copepoda), of which only 3, Daphnia longispina, Eucyclops serrulatus and Cyclops strenuus, were dominant species and another 6 subdominant, Brachionus rubens, Asplanchna priodonta, Lecane bulla, Moira rectirostris, Dunhevedi crassa, Bosmina longirostris. Data are given on the seasonal change of the numbers and biomass of these 9 species. The species composition, number and biomass of zooplankton of the Akstafa reservoir are compared with other reservoirs of the Azerbaijan SSR.—Copyright 1976, Biological Abstracts, Inc.  
W77-00416

**SURFACE WATER SUPPLY OF THE UNITED STATES, 1966-70: PART 4. ST. LAWRENCE RIVER BASIN—VOLUME 2. ST. LAWRENCE RIVER BASIN BELOW LAKE HURON.** Geological Survey, Reston, Va.  
For primary bibliographic entry see Field 4A.  
W77-00431

**THE NUTRIENTS AND PLANTS OF LAKE JOONDALUP, A MILDLY EUTROPHIC LAKE EXPERIENCING LARGE SEASONAL CHANGES IN VOLUME,** Western Australia Univ., Nedlands. Dept. of Botany.  
For primary bibliographic entry see Field 5C.

W77-00442

**A COMPARATIVE STUDY OF THE LIMNOLOGY OF THREE MAAR LAKES IN WESTERN VICTORIA (AUSTRALIA), 1. PHYSIOGRAPHY AND PHYSICOCHEMICAL FEATURES,** Monash Univ., Clayton (Australia). Dept. of Zoology.  
B. V. Timms.  
Australian Journal of Marine and Freshwater Research, Vol 27, No 1, p 35-60, March 1976. 16 fig, 8 tab, 40 ref.

Descriptors: \*Saline lakes, Aquatic environment, Limnology, \*Australia, Lakes, Craters, \*Salinity, Water temperature, Dissolved oxygen, Light penetration, Stratification, Lake sediments, Hydrogen ion concentration, Seasonal, Organic matter, Oxygenation, Oxidation-reduction potential.  
Identifiers: Lake Purrumbete(Vic.), Lake Bullenmer(Vic.), Lake Gnotuk(Vic.), \*Maar lakes(Australia).

Three typical maar lakes in western Victoria were selected for study because although of similar size, altitude and (volcanic) origin, they vary in salinity from fresh to markedly saline, providing an unusually favourable opportunity for investigating the effect of salinity on the ecology of athalassic lakes. The major physiographic and physicochemical features of the lakes are described, with emphasis on variation, between lakes and seasonally. Factors discussed include salinity, pH, oxygenation, temperature, transparency, stratification, and the nature, organic matter content and redox potentials of the sediment. (CSIRO)  
W77-00447

**YELLOW SUBSTANCE (GELBSTOFF) AND ITS CONTRIBUTION TO THE ATTENUATION OF PHOTOSYNTHETICALLY ACTIVE RADIATION IN SOME INLAND AND COASTAL SOUTH-EASTERN AUSTRALIAN WATERS,** Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Plant Industry.  
For primary bibliographic entry see Field 5C.  
W77-00448

**NUTRIENT STATUS OF THE SEDIMENTS IN LAKE MULWALA, 1. TOTAL PHOSPHORUS,** Caulfield Inst. of Tech. (Australia). Dept. of Chemistry.  
For primary bibliographic entry see Field 5C.  
W77-00450

**NUTRIENT ECONOMIES AND TROPHIC STATUS OF LAKES SORELL AND CRESCENT, TASMANIA (AUSTRALIA),** Tasmania Univ., Hobart (Australia). Dept. of Botany.  
For primary bibliographic entry see Field 5C.  
W77-00451

**FATE OF SELECTED ORGANIC COMPOUNDS IN THE DISCHARGE OF KRAFT PAPER MILLS INTO LAKE SUPERIOR,** Canada Centre for Inland Waters, Burlington, (Ontario).  
For primary bibliographic entry see Field 5B.  
W77-00457

**PERSISTENT ORGANIC COMPOUNDS FROM A PULP MILL IN A NEAR-SHORE FRESH-WATER ENVIRONMENT,** Canada Centre for Inland Waters, Burlington, (Ontario).  
For primary bibliographic entry see Field 5B.  
W77-00458



**LAKES MARION-MOULTRIE STREAM SYSTEM INVESTIGATION: PART II-SIMULATION STUDIES,**  
Geological Survey, Columbia, S.C.  
For primary bibliographic entry see Field 4A.  
W77-00488

**MORPHO-ECOLOGICAL CHARACTERISTICS OF THE IDE, LEUCISCUS IDUS (LINNE), FROM THE KREMENCHUG RESERVOIR. (IN RUSSIAN),**  
Akademiya Nauk URSS, Kiev. Instytut Hidrobiologii.  
V. P. Bruenko, Yu. V. Movchan, and A. I. Smirnov.  
Gidrobiol Zh. 10(5), p 70-79, 1974.

Descriptors: Fish, \*Freshwater fish, Fish genetics, Fish physiology, Fish populations, Fish reproduction, Reservoirs.  
Identifiers: \*Ide, Kremenchug reservoir (USSR) Leuciscus-Idus, Ukrainian-SSR, \*USSR.

Analyses based on morphometry, size-weight and age compositions, growth rate, fatness, fecundity and reproduction peculiarities of ide in the Kremenchug (Ukrainian SSR, USSR) show small changes in its ecological niche. A considerable increase was observed in the recent catch. The reasons for this phenomenon are considered and measures to preserve the reserves are recommended.—Copyright 1975, Biological Abstracts, Inc.  
W77-00504

**CONSUMPTION OF ORGANIC MATTER OF MUDS BY ILYOCRYPTUS SORDIDUS (CLADOCERA, MACROTHRICIDAE), (IN RUSSIAN),**  
Akademiya Nauk SSSR, Moscow. Institut Biologii Vnutrennykh Vod.  
For primary bibliographic entry see Field 5C.  
W77-00507

**CHEMICAL COMPOSITION AND FOOD VALUE OF SOME MEMBERS OF FRESH-WATER ZOOPLANKTON IN PONDS OF THE SOUTHERN MOLDAVIAN SSR, (IN RUSSIAN),**  
V. I. Ashevskii.  
Izv Akad Nauk Mold SSR Ser Biol Khim Nauk. 6, p 49-53, 1974.

Descriptors: \*Zooplankton, \*Chemical properties, Crustaceans, Copepods, Phytoplankton, \*Mineral water, Ponds.  
Identifiers: Acanthocyclops-Cernalis, Bosmina-Longirostris, Cladocera, Cyclops-Vicinus, Daphnia-Magna, Diaptomus-Coeruleus, Keratella-Quadrata, Moina-Micrura, Moldavian-SSR, Rotatoria, USSR, Food value.

The dependence of the chemical composition of some members of freshwater zooplankton (Rotatoria: Keratella quadrata; Cladocera: Daphnia magna, Moina micrura, Bosmina longirostris; Copepoda: Cyclops vicinus, Acanthocyclops vernalis, Diaptomus coeruleus) on the composition and quantity of phytoplankton and degree of mineralization of water in some ponds in the southern Moldavian SSR (USSR) is discussed. The content of mineral substances in members of Cladocera and Copepoda depends not only on the degree of mineralization of the water but also on the quantitative relationship of the calcium carbonate equilibrium in it. In a food respect (total content of fat, protein and organic matter) the investigated members of Copepoda are distinguished by a greater calorific value than the investigated members of Cladocera, except for B. longirostris having a maximum calorific value (6.78%). The chemical composition of the investigated crustaceans is subject to considerable variation depending on the ecological and trophic conditions of the ponds.—Copyright 1975, Biological Abstracts, Inc.  
W77-00509

**SEASONAL SUCCESSION AND VERTICAL DISTRIBUTION OF PHYTOPLANKTON IN LAKE HAYES AND LAKE JOHNSON, SOUTH ISLAND, NEW ZEALAND,**  
Otago Univ., Dunedin (New Zealand). Dept. of Zoology.  
For primary bibliographic entry see Field 5C.  
W77-00517

**FECUNDITY OF NELMUSCHKA COREGONUS LAVARETUS NELMUSCHKA PRAVDIN AND ITS ECOLOGICAL BACKGROUND, (IN RUSSIAN),**  
Vologodskii Gosudarstvennyi Pedagogicheskii Institut (USSR).  
V. G. Lebedev.  
Vopr Ikhtiol. 15(1), p 58-63, 1975.

Descriptors: \*Lakes, Fish, \*Fish reproduction, \*Environmental effects, Ecology.  
Identifiers: Coregonus-lavaretus-nelmuschka, Nelmuschka, Russian-SFSR, USSR, \*Whitefish, \*Beluga.

The results of an investigation of the dwarf lake-river whitefish, nelmuschka (C. lavaretus nelmuschka) in Lake Kubenskoye in the Vologda Oblast of the Russian SFSR (USSR) are presented. The Kubenskoye nelmuschka is characterized by a decrease in absolute fecundity and increase of relative fecundity and of species fecundity in comparison with other forms of this species. The fecundity of the nelmuschka depends not only on body weight but on environmental conditions. The dwarf growth and fecundity characteristics are evidence that the Kubenskoe nelmuschka exists at the extreme limits of its ecological amplitude. Any deterioration of the habitat of this whitefish will cause its death.—Copyright 1975, Biological Abstracts, Inc.  
W77-00518

**ROLE OF PREDATORY CLADOCERA IN THE FEEDING OF THE CHARKHAL KILKA CLUPEONELLA DELICATULACASPIA MORPHA TSCHARCHALENSIS (BORODIN) IN KUIBYSHEV RESERVOIR, (IN RUSSIAN),**  
Akademiya Nauk SSSR, Tolyatti. Institut Biologii Vnutrennykh Vod.  
A. V. Kogan.  
Vopr Ikhtiol. 15(1), p 126-130, 1975.

Descriptors: \*Predation, \*Crustaceans, \*Reservoirs, \*Smelts, Zooplankton, \*Fish food organisms, \*Fish diets, Seasonal.  
Identifiers: Bythotrephes-longimanus, Charkhal smelts, Clupeonella-delicatula-caspia-tschar, Kilka, Kuibyshev reservoir, Leptodora-kindtii, Russian-SFSR, USSR.

An analysis was made of the food spectrum of underyearling and yearling Charkhal kilka (Clupeonella delicatula caspia m. tscharchalensis) and its seasonal and local variations in the e Kuibyshev Reservoirs (Russian SFSR, USSR.) on the Volga. Indices of selection of food objects of the 2 age groups were calculated. From the end of the 1st summer, large predatory forms of zooplankton such as Leptodora kindtii and Bythotrephes longimanus became the favorite food of the kilka. To evaluate the role of the kilka in a body of water the consumption of predatory and filter-feeding forms of zooplankton by the kilka school should be investigated.—Copyright 1975, Biological Abstracts, Inc.  
W77-00520

## 21. Water In Plants

**PRESENCE OF SPRING AND WINTER RACES OF THE NELMA IN THE OB RIVER, (IN RUSSIAN),**  
N. A. Prusevich.  
Ekologiya. 6(2), p 88-90, 1975.

Descriptors: \*Fish, Anadromous fish, Rivers, Fish reproduction, \*Spawning, Seasonal.  
Identifiers: \*Nelma, Ob River, Russian-SFSR, \*Stendous-Leucichthys-Nelma, USSR.

The nelma (Stendous leucichthys nelma) is valuable semi-anadromous fish of the Ob basin (Russian SFSR, USSR). Two independent races of the nelma, spring and winter, exist in the Ob River. This division of the nelma into winter and spring races is a species adaptation permitting maximum use of the Upper Ob with its favorable breeding condition as a spawning ground. The winter race is probably an intermediate step from the purely semi-anadromous spring form to a freshwater form.—Copyright 1976, Biological Abstracts, Inc.  
W77-00057

**STUDY OF THE URAL RIVER BENTHOS, (IN RUSSIAN),**  
Tsentrlnnyi Nauchno-Issledovatel'skii Institut Osetrovogo Khozyaystva, Guryev (USSR). Ural'skii-Kaspiiskii Otdelenie.  
T. I. Zachetnova.  
Gidrobiol Zh. 11(2), p 34-38, 1975.

Descriptors: \*Rivers, \*Benthos, Population, \*Biomass, Distribution, Diptera, Dragonflies, \*Oligochaetes, Invertebrates.  
Identifiers: \*Corophidae, \*Sturgeon, \*Ural River, USSR, \*Zoobenthos.

Data on the quantitative distribution of zoobenthos in the lower reaches of the Ural River (USSR) are given for the 1st time. Zoobenthos is significant for reproduction of sturgeon. The species composition of the predominant forms is presented. The number of benthic invertebrates varies from 40-5740 (average, 764) samples/m<sup>2</sup>, biomass from 0.05-20.00 (average, 2.54) g/m<sup>2</sup>, and taking into account large mollusks, 10.46 g/m<sup>2</sup>. The numbers of Oligochaeta, Corophidae, and Chironomidae are largest. The maximum biomass was observed for Chironomidae, Oligochaeta and dragon-fly larvae. The highest density indices were those of the larvae of Chironomidae (6.64), Oligochaeta (6.18) and Corophidae (3.67).—Copyright 1976, Biological Abstracts, Inc.  
W77-00091

**PILOT INVESTIGATION OF THE IMPORTANCE OF VARIOUS WETLAND TYPES TO DUCK PRODUCTION,**  
South Dakota State Univ., Brookings. Dept. of Wildlife and Fisheries.  
For primary bibliographic entry see Field 2H.  
W77-00145

**LEAF PHOTOSYNTHESIS: THE INFLUENCE OF ENVIRONMENTAL VARIABLES,**  
Purdue Univ., Lafayette, Ind. Dept. of Mechanical Engineering.  
F. P. Incropera.  
Journal of Environmental Quality, Vol. 4, No. 4, p 440-447, October-December 1975. 13 fig, 35 ref, append.

Descriptors: \*Crop response, \*Model studies, \*Corn(Field), \*Photosynthesis, Environmental effects, Environmental control, Environment, \*Leaves, Mathematical models.  
Identifiers: \*Leaf photosynthesis.

A model is presented for the effects of light intensity and ambient temperature, relative humidity, and carbon dioxide concentration on leaf photosynthesis. The model treats diffusion and chemical processes occurring within the leaf, as well as the transfer of mass and energy between the leaf and its environment. Calculations have been performed for Zea mays L. (maize) which suggest the influence of environmental changes. Although leaf energy exchange processes act to moderate the effect of changes in the atmospheric temperature, a severe cooling trend may cause as

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much as 20% reduction in photosynthesis. Under most conditions, the rate of photosynthesis is further diminished by a reduction in relative humidity. In contrast, a 20% increase in the atmospheric CO<sub>2</sub> concentration, which is projected for the year 2000, will increase photosynthesis by approximately 15%. The calculations also suggest optimum ambient conditions for controlled growth environments such as a green house. (Skogerboe-Colorado State)  
W77-00302

#### PHYLOGENY OF THE FAMILY CALANIDAE(COPEPODA) ON THE BASIS OF A COMPARATIVE MORPHOLOGICAL ANALYSIS OF ITS CHARACTERS.

Akademiya Nauk SSSR, Leningrad.  
Zoologicheskii Institut.  
For primary bibliographic entry see Field 5C.  
W77-00394

#### INTRODUCTION TO THE KNOWLEDGE OF FRESHWATER INVERTEBRATES AND THEIR ENVIRONMENT, (IN DUTCH).

Rijksinstituut voor Natuurbeheer, Leersun (Netherlands).  
L. W. G. Higler.  
Wet Meded K N N V (K Ned Natuurhist Ver), 103, p 1-40, 1975.

Descriptors: \*Invertebrates, \*Freshwater animals, Analytical techniques, Sampling, \*Ecology, Water pollution, Energy, \*Environment, \*Bioindicators. Identifiers: \*Netherlands.

This introduction is meant for beginners in the study of freshwater invertebrates, students and laymen. A simple key is given for visible and moving invertebrates, leading to existing keys at the order level. Most figures are given as examples of these orders. Sampling and conservation are discussed. Some ecological principles on bio-communities are considered, based on food chain and energy flow. The various kinds of water pollution and of saprobic systems are explained. The possibilities and the failure of these systems in the Dutch waters are discussed. A number of organisms that can be used in the Netherlands as indicators of more or less polluted situations on the basis of existing saprobic systems, are described.—Copyright 1976, Biological Abstracts, Inc.  
W77-00410

#### SIGNIFICANCE OF WATER VEGETATION IN DESMAN LANDS OF THE EUROPEAN SECTION OF THE USSR, (IN RUSSIAN).

Akademiya Nauk URSR, Voroshilovgrad.  
Voroshilovgrad State Reservation.  
V. P. Samarin.  
Vestn Zool. 3, p 25-28, 1975.

Descriptors: \*Rivers, \*Vegetation, Aquatic animals, \*Mammals, \*Rodents, Europe, Ecology, \*Plant growth, Growth rates.  
Identifiers: \*Desman lands, Desmana-Moschata, \*USSR.

Ecological conditions of desman lands were studied for 1971-1972 in the Voroshilovgrad State Reservation of the Ukrainian Academy of Sciences (USSR). The areas in the high-water beds of the rivers Kotorosl (the Yaroslavl Oblast), Oka (the Murom district, the Vladimir Oblast), Bitung and Khoper (the Voronezh Oblast) most densely inhabited by desman (Desmana Moschata) were also examined in the autumn of 1972. A definite relationship was found between the growth of vegetation in the rivers and density of desman.—Copyright 1976, Biological Abstracts, Inc.  
W77-00411

#### CALORIC VALUES OF THE MOST ABUNDANT INVERTEBRATES OF TWO WOODLAND-

BROOKLETS OF THE 'NATURPARK KOTTENFORST-VILLE', (IN GERMAN),  
Bonn Univ. (West Germany). Institut fuer Landwirtschaftliche Zoologie und Bienenkunde.  
N. Caspers.  
Arch Hydrobiol. 75(4), p 484-489, 1975.

Descriptors: \*Invertebrates, Heat, Brooks, Energy, Streams, Europe.  
Identifiers: \*Caloric values(Invertebrates), \*West Germany, Aeschna-cyanea, Asellus-aquaticus, Baetis-rhodani, Crenobia-alpina, Dugesia-gonocephala, Erpobdella-octoculata, Eusimulium-sp., Gammarus-fossarum, Glossiphonia-complanata, Hydropsyche-sp., Invertebrates, Isoperla-gortzi, Kottenforst, Leptophlebia-marginata, Limnephilidae, Naturpark, Nemoura-sp., Plectrocnemia-conspersa, Radix-peregrina-ovata, Rhithrogena-semicolorata, Rhyacophila-fasciata.

Caloric values of 18 abundant invertebrates of 2 woodland brooklets near Bonn (West Germany) were determined on a dry weight basis and on an ash-free dry weight basis. (Crenobia alpina, Dugesia gonocephala, Radix peregrina ovata, Glossiphonia complanata, Erpobdella octoculata, Asellus aquaticus, Gammarus fossarum, Baetis rhodani, Rhithrogena semicolorata, Leptophlebia marginata, Nemoura sp., Isoperla gortzi, Aeschna-cyanea, Rhyacophila fasciata, Hydropsyche sp., Plectrocnemia conspersa, Eusimulium sp., Limnephilidae).—Copyright 1976, Biological Abstracts, Inc.  
W77-00415

#### BIOHYDRODYNAMIC CHANNEL FOR FIELD TRIPS, (IN RUSSIAN).

Institute of Biology of the Southern Seas, Sevastopol (USSR).  
For primary bibliographic entry see Field 7B.  
W77-00417

#### EFFECT OF OSMOTIC SUCTION ON THE GERMINATION OF WARM SEASON GRASSES, (IN JAPANESE).

Kyushu Agricultural Experiment Station, Kumamoto (Japan).  
K. Okamoto, M. Kawatake, and S. Horiuchi.  
J Jpn Soc Grassl Sci. 21(1), p 16-20, 1975.

Descriptors: \*Grasses, Soil moisture, \*Osmotic pressure, \*Germination, \*Sorghum.  
Identifiers: Love grass, Makarikari grass, Millet, Panicum-Spp., Rhodes grass, \*Osmotic suction.

This study was undertaken to obtain information for selecting the warm season grasses suitable for mineral soil which has poor physical conditions and to control the soil moisture conditions in seed bed layer by watering or other methods. The relationships between osmotic suction (+ atm) and the seed germination of warm season grasses as examined in a controlled temperature room kept at 29-30 C. Osmotic solutions were prepared and adjusted by polyethylene glycol. The germination percentage in all species lowered with the increase of osmotic suction, but the degree of decline varied considerably. Germination characteristics among the species differed by the levels of osmotic suction. In general, the germination percentage in those species with relatively small seeds such as Panicum spp. and Rhodes grass was much more severely affected and lowered by lower osmotic suction in comparison with the spp. with large seeded taxa such as Sorghum and millet. Among the species of small seed, Love grass and Makarikari grass were least severely affected. The germination rate of almost all species declined linearly with the increase of osmotic suction, but interspecific differences were not as recognizable as those observed in the decline of germination percentage.—Copyright 1976, Biological Abstracts, Inc.  
W77-00422

#### EFFECT OF SOIL WATER SUCTION ON THE GERMINATION AND EMERGENCE OF WARM SEASON GRASSES, (IN JAPANESE).

Kyushu Agricultural Experiment Station, Kumamoto (Japan).  
K. Okamoto, and S. Horiuchi.  
J Jpn Soc Grassl Sci. 21(1), p 21-25, 1975.

Descriptors: \*Grasses, Soil moisture, \*Osmotic pressure, \*Germination, Sorghum.  
Identifiers: Millet, Panicum-Spp., Rhodes grass, Osmotic suction.

The interrelation between soil water suction and germination and the emergence above the soil surface after germination was investigated at 30 C constant temperature using representative warm season grasses. Water suction-water content curve of the mineral soil was tested. The percentage of germination and emergence of all spp. did not vary at the lower levels of soil water suction and decreased rapidly at some levels above the limit of water suction. The degree of such decline varied by the species and Sorghum spp. and millet emerged well in the higher levels of soil water suction. Among the small seed species, Panicum spp. and Rhodes grass were much more severely affected at increased soil water suction and decreased rapidly at some levels over the limit of water suction. Soil water suction values permitting the relative germination and emergence percentage of 0% and 50% (percentage of 0.03 atm = 100) and also that over which emergence percentage lowered rapidly are given. The rate of emergence of most species declined slowly with the increase of soil water suction at the lower levels in which the percentage of emergence did not decline and decreased rapidly at the levels above the limit of water suction. There were no differences among the species in the degree of such reduction.—Copyright 1976, Biological Abstracts, Inc.  
W77-00423

#### EFFECT OF IRRIGATION PUMPING ON DESERT PUFFISH HABITATS IN ASH MEADOWS, NYE COUNTY, NEVADA.

Geological Survey, Carson City, Nev.  
For primary bibliographic entry see Field 8L.  
W77-00427

#### SPECIES DIVERSITY OF FRESHWATER PLANKTON AGGLOMERATIONS, (IN POLISH).

For primary bibliographic entry see Field 7B.  
W77-00495

#### THE BROADLEAF EVERGREEN FORESTS OF JAPAN, (IN GERMAN).

For primary bibliographic entry see Field 4A.  
W77-00499

#### WATER RELATIONS OF GLYCRRHIZA GLABRA L. UNDER DESERT CONDITIONS.

Cairo Univ., Giza (Egypt). Dept. of Botany; and Cairo Univ., Giza (Egypt). Faculty of Science.  
A. A. Abd El-Rahman, K. H. Batanouny, and K. M. Zayed.  
Flora (Jena). 163(1/2), p 143-155, 1974.

Descriptors: \*Deserts, \*Plant growth substances, \*Soil-water-plant relationships, \*Transpiration, Osmotic pressure, \*Water requirements, Moisture uptake, \*Drought tolerance.  
Identifiers: \*Glycyrrhiza-glabra.

The water relations of *G. glabra* L. under desert condition, including the water expenditure, osmotic pressure of the plant sap and the water saturation deficit, were studied in different localities. Transpiration measurements show that the plant transpires at relatively higher rates than desert plants. The curves of the diurnal march of the transpiration and those of the stomatal aperture showed almost the same trend, indicating a

strong stomatal control on transpiration. There is lack of parallelism between both curves and those of the climatic factors, particularly in dry months. Two types of transpiration curves are recognized, viz. the single-peaked curves with early maximum in dry months and the dome-shaped curves without prominent peak in months with mild climatic conditions. Comparison of the mean monthly transpiration rates in 2 localities revealed that the transpiration was higher in the locality with better water supply. Generally, there is a discrepancy between the mean values of transpiration and those of vapor pressure deficit and evaporation. The plant exhibited high values of osmotic pressure and water saturation deficit which increased later in the growing season. These values were higher in the locality with relatively low available soil moisture. The plant withstands high water deficits for long periods. The mechanisms for drought endurance are discussed.—Copyright 1975, Biological Abstracts, Inc. W77-00500

**DIET OF HIPPOGLOSSINA MACROPS (STEINDACHNER) IN MEJILLONES (PISCES, BOTHIDAE), (IN SPANISH),** Universidad de Norte, Antofagasta (Chile). For primary bibliographic entry see Field 2L. W77-00502

**EFFECT OF DEHYDRATION AND ELEVATED TEMPERATURE ON LEAF CELL THERMORESISTANCE OF A DROUGHT-SENSITIVE BARLEY CULTIVAR, (IN RUSSIAN),** Akademiya Nauk SSSR, Leningrad. Lab. of Cytophysiology and Cytoecology. I. G. Zavadskaya, and G. G. Shukhtina. Tsitologiya. 16(8), p 950-955, 1974.

Descriptors: \*Barley, \*Drought tolerance, Heat balance, \*Soil-water-plant relationships, \*Dehydration, Water requirements, Cultivation. Identifiers: Hordeum-Sativum.

Dehydration of intact plants or detached leaves of the drought-sensitive barley (*Hordeum sativum*) cultivar 'Winer' did not affect the primary cellular thermoresistance. Heat hardening of whole plants treated with soil drought for 4 days (decrease of water content in leaves by 35%) increased resistance of cells to heating, shifting the curves towards the area of higher temperatures as compared to the curve of thermoresistance of cells heat-hardened in saturated state. Rapid dehydration for 3 h (loss of water in leaves by 35%) of detached leaves did not produce additional effects during heat hardening. In contrast to the situation with 'Winer' drought-sensitive varieties required prolonged dehydration treatment to obtain enhanced effect of heat hardening.—Copyright 1975, Biological Abstracts, Inc. W77-00503

**MORPHO-ECOLOGICAL CHARACTERISTICS OF THE IDE, LEUCISCUS IDUS (LINNE), FROM THE KREMENCHUG RESERVOIR. (IN RUSSIAN),** Akademiya Nauk URSR, Kiev. Instytut Hidrobiologii. For primary bibliographic entry see Field 2H. W77-00504

**ON THE INFLUENCE OF WATER CURRENTS ON THE GROWTH OF HYDRORHIZAL COLOINIES, (IN GERMAN),** Ruhr-Universitaet Bochum (West Germany). Institut fuer Spezial Zoologie. V. Petriconi, and G. Pickert. Verh Dtsch Zool Ges. 67, p 107-111, 1974.

Descriptors: \*Plant growth, \*Currents(Water), \*Rheotropism, Method, Measurement. Identifiers: Eirene-Viridula, \*Hydrorhizal colonies, \*Stolons.

A water tunnel for studying the influence of current on stolon colonies is described. A new method for measuring rheotropism is introduced. Eirene viridula (Hydroidea) prefers growing against the direction of flow. A stolon fragment when settled perpendicular to the direction of water flow starts bipolar branching with increased unilateral outgrowth of stolons against the direction of flow; when settled parallel to the water movement, branching is unipolar against the direction of flow.—Copyright 1975, Physiological Abstracts, Inc. W77-00506

**CHEMICAL COMPOSITION AND FOOD VALUE OF SOME MEMBERS OF FRESH-WATER ZOOPLANKTON IN PONDS OF THE SOUTHERN MOLDAVIAN SSR, (IN RUSSIAN),** For primary bibliographic entry see Field 2H. W77-00509

**METHOD OF SIMULTANEOUS DETERMINATION OF WATER CONDUCTIVITY OF SOILS AND PLANTS, (IN RUSSIAN),** Moscow State Univ. (USSR). Dept. of Soil Physics and Reclamation. E. V. Shein. Biol Nauki. 17(12), p 125-129, 1974.

Descriptors: \*Water pressure, Soils, Corn(Field), Beans, Transpiration, \*Soil-water-plant relationships, Water utilization, \*Conductivity, \*Hydraulic conductivity, Capillary conductivity. Identifiers: Horse beans.

The water pressure in soil, roots and leaves of horse beans and corn and the transpiration of plant leaves were studied. The coefficients of water conductivity of soils and plants were then calculated. During soil drought the coefficient of water conductivity of plants is 150-200 times greater than that of soil and does not considerably affect water transport. The main part of the total resistance to water transport in the soil-plant system is concentrated in the soil.—Copyright 1975, Biological Abstracts, Inc. W77-00512

**SEASONAL ACTIVITY AND ENVIRONMENTAL CONTROL OF FORAGING OF THE SUBTERRANEAN TERMITE, HETEROTERMES AUREUS (SNYDER), IN A DESERT GRASSLAND,** Arizona Univ., Tucson. Dept. of Entomology. M. I. Haverty, J. P. Lafage, and W. L. Nutting. Life Sci. 15(6), p 1091-1101, 1974.

Descriptors: Grasslands, Deserts, \*Arizona, \*Sampling, \*Analytical techniques, Environmental factors, Rainfall, Temperature, \*Feeding rates. Identifiers: \*Foraging, \*Heterotermes-Aureus, \*Termites.

This research was conducted on a shrub-invaded desert grassland ecotone 40 km S of Tucson, Arizona. To examine the abiotic factors affecting or regulating foraging of subterranean termites, a modified bait sampling method using toilet paper rolls was developed. Observations of foraging activity of *H. aureus* (Snyder) were made during 24-h periods each wk for 1 yr. Pertinent environmental data were collected at each check. *H. aureus* foraged day and night throughout most of the yr with minimal activity from Dec.-Feb. Foraging intensity increased moderately in the spring and fall and was high but erratic during the summer months. The number of foragers generally increased with increasing temperature. Rainfall had little effect on foraging when daily mean soil temperature were below 20°C (toilet paper roll-soil interface); however, even the slightest amount of rain during the hot summer months greatly increased foraging intensity. Above 33°C, even with precipitation, foraging numbers plummeted. The number of surface foragers at any instant (Y) is

best explained by the equation,  $\ln Y = -0.985 - 0.0761 T + 2.928 \ln T + 0.327 \ln R$  where T is the temperature at the roll-soil interface and R is daily rainfall. It appears that foraging activity is not endogenously controlled; rather it is exogenously controlled by temperature and moisture.—Copyright 1975, Biological Abstracts, Inc. W77-00515

**EVOLUTIONARY ASPECT OF THE REPRODUCTIVE ECOLOGY OF SALMON OF THE GENUS SALMO IN SOME WATER BODIES OF KAMCHATKA, (IN RUSSIAN),** Moscow State Univ. (USSR). Dept. Of Ichthyology. K. A. Savvaitova, M. V. Mina, and V. A. Maksimov. Vopr Ikhtiol. 15(1), p 21-31, 1975.

Descriptors: \*Rivers, \*Salmon, Population, \*Fish populations, \*Spawning, Fish reproduction. Identifiers: Kamchatka, Russian-SFSR, Salmo-mykiss, USSR.

The absence of freshwater populations of the Kamchatka salmon *S. mykiss* in the basins of small rivers of the W coast of Kamchatka (Russian SFSR, USSR) is probably due to the insufficient food content of these rivers. The absence of a migratory form in the Kamchatka River basin is due to the lack of suitable spawning grounds. During the evolution of the freshwater form of *S. mykiss* from the migratory form, the settlement of small streams occurred. The main factor that limited the abundance of spawning populations was apparently the lack of a spawning substrate. The high food content of the Kamchatka River basin enabled the salmon, having been transformed from a migratory to a freshwater form, to shorten the migration route (and thereby to reduce energy expenditures) while preserving the general scheme of the life cycle of the migratory form.—Copyright 1975, Biological Abstracts, Inc. W77-00519

**CAUSES OF A GREATER EFFECT OF PREDATORS ON NON-PREDATORY FISH POPULATIONS IN LOW LATITUDES, (IN RUSSIAN),** Akademiya Nauk SSSR, Moscow. Inst. of Evolutionary Morphology and Animal Ecology. G. V. Nikol'skii. Zh Obshch Biol. 35(3), p 346-352, 1974.

Descriptors: \*Predation, \*Fish prey, Fish diets, \*Food chains, Tropic, \*Tropical regions, Fish food organisms.

An analysis of the ratio of fishes with different modes of feeding in the faunas of marine and continental water bodies shows that, in low latitudes, predatory fishes feeding mainly on herbivorous ones represent the 3rd link in food chains. This and better utilization of food explain their higher proportion in the tropics than in the temperate zones.—Copyright 1975, Biological Abstracts, Inc. W77-00521

**FEEDING OF SHEEFISH IN THE UPPER OB ABOVE THE DAM OF THE NOVOSIBIRSK HYDROELECTRIC STATION, (IN RUSSIAN),** Tomskii Pedagogicheskii Institut (USSR). Lab. of Ecology. L. A. Koneva. Biol Nauki. 16(9), p 24-27, 1973.

Descriptors: \*Fish, Rivers, Dams, \*Fish populations, \*Fish reproduction, \*Fish diets, \*Growth rates. Identifiers: Gobio-gobio, Leuciscus-idus, Novosibirsk, Perch, Pike, Ruff, Rutilus-rutilus, \*Sheefish, Stenodus-leucichthys-nelma, \*USSR, \*Ob River.

An investigation of the feeding of the population of river-bound sheefish (*Stenodus leucichthys*



## Field 2—WATER CYCLE

### Group 21—Water In Plants

nelma) formed upstream of the Novosibirsk hydroelectric station dam showed age-associated and seasonal changes in the food spectrum of the sheefish in comparison with the semi-anadromous sheefish of the Ob River (USSR). The absence of competition with other predators for food and the abundance of the roach (*Rutilus rutilus*), which is the main food of the sheefish in all seasons, indicates that the trophic conditions in the newly created body of water are favorable for the sheefish and promote its rapid growth and high reproductive capacity. (*Leuciscus idus*, perch, pike, ruff, Gobio gobio and bream are also cited as food.)—Copyright 1975, Biological Abstracts, Inc. W77-00522

**ECOLOGICAL AND PHYSIOLOGICAL PATTERNS OF POLYARTEMIA FORCIPATA (ANOSTRACA) FROM TUNDRA WATER BODIES OF THE EAST MURMAN, (IN RUSSIAN),** Akademiya Nauk SSSR, Leningrad. Zoologicheskii Institut. M. B. Ivanova, and E. V. Korobitsova. Zool Zh. 53(8), p 1140-1147, 1974.

Descriptors: \*Temperature, Lakes, Sampling, Tundra, \*Cold regions, \*Fish physiology, Ecological distribution, Distribution patterns, Oxygen. Identifiers: \*Anostraca, Bythotrephes-longimanus, Murmansk, \*Polyartemia-forcipata, Russian-SFSR, USSR, Oxygen consumption (Fish), Rate of filtration (Fish).

The effect of temperature on the intensity of O<sub>2</sub> consumption (OC) and the rate of filtration (RF) was studied in *P. forcipata*. The OC was determined in specimens previously adapted to the temperature of the experiment (weight, 7.1-29 mg; duration of experiment, 4-5 h). OC calculated from body weight in *P. forcipata* agrees well with that calculated according to Sushchenya (1972). The RF was determined by the change of concentration of silt suspension in 1.5-2 h experiments and calculated according to Gauld (1952). OC and RF, at temperatures of 5-25°C, change in the same way, and the value F/Q (ml water/mg O<sub>2</sub>) is almost constant. OC and RF attain a maximum value at 15°C and then decrease with a subsequent increase of temperature. The growth curve of *P. forcipata* in the lake (Russian SFSR, USSR) was constructed, and the energy balance for a growing specimen was calculated from samples taken in July-Aug. K<sub>2</sub> decreases during a life span from 0.53-0.25; C/W (ratio to body weight) from 21.3-8.2%; A/W (Assimilated food to body weight) from 12.8-4.9%; and R/W (metabolic expenses to body weight) from 6.2-3.7%. Bythotrephes longimanus is mentioned as a predator.—Copyright 1975, Biological Abstracts, Inc. W77-00525

### 2J. Erosion and Sedimentation

**ASSOCIATIONS OF CHLORINATED HYDROCARBONS WITH FINE PARTICLES AND HUMIC SUBSTANCES IN NEARSHORE SURFICIAL SEDIMENTS,** University of Southern California, Los Angeles. Environmental Engineering Program. For primary bibliographic entry see Field 5A. W77-00086

**GUIDELINES FOR SEDIMENT CONTROL IN IRRIGATION RETURN FLOW,** Agricultural Research Service, Kimberly, Idaho. Snake River Conservation Research Center. For primary bibliographic entry see Field 5G. W77-00090

**A CONCEPTUAL MODEL OF OFFSHORE PERMAFROST,** Alaska Univ., College. Geophysical Inst. For primary bibliographic entry see Field 2C.

W77-00094

**GULLY DEVELOPMENT AND CONTROL: THE STATUS OF OUR KNOWLEDGE,** Forest Service (USDA), Tempe, Ariz. Rocky Mountain Forest and Range Experiment Station. B. H. Heede. USDA For. Serv. Res. Pap. RM-169, May 1976. 42 p, 36 fig, 81 ref.

Descriptors: \*Gullies, \*Gully erosion, \*Erosion control, \*Watershed protection, \*Check structures, Grassed waterways, Sediment deposition, Bank protection, Riprap, Vegetation establishment, Design criteria, Structural design, Construction, History, Reviews, Bibliographies. Identifiers: Gully mechanics, \*Gully processes, \*Gully growth models, \*Gully control systems, Design equations, Flow-sediment relations, Gully control history.

To establish scientific management of gullies, knowledge on gully mechanics, processes and morphology must be enhanced. Even where data on flows and sediment loads are available, the application of physical laws and known theoretical relationships require engineering judgment in predicting gully development and designing control systems. Field projects indicate that simply built rock check dams can be effective control structures. Their construction, costs, and functional relationships are therefore emphasized. (Forest Service) W77-00097

**MODELING OF SOIL MOVEMENT ACROSS A WATERSHED,** Missouri Univ., Columbia. Dept. of Civil Engineering. A. T. Hjelmfelt, Jr. Available from the National Technical Information Service, Springfield, VA 22161 as PB-258 918. Price codes: A04 in paper copy, A01 in microfiche. Completion Report, June 15, 1976. 64 p, 19 fig, 2 tab, 17 ref. OWR A-076-MO(1), 14-31-0001-5025.

Descriptors: Watershed management, \*Erosion, Digital computers, Soils, Model studies, \*Mathematical models, \*Agricultural watersheds, \*Sediment transport, Fluid flow, Equations, Sediment load. Identifiers: \*Kinematic wave equations.

A mathematical model for analysis of flow and soil movement across an agricultural watershed is discussed. Erosion due to rainfall on upland areas is described by the continuity-of-mass transport equation and relationships for interrill sediment detachment and the interaction between flow detachment and sediment load. The fluid flow is described by the kinematic wave equations. The flow detachment and transport capacities are taken to be power functions of the flow depth. The interrill detachment is assumed to be proportional to the effective precipitation rate. The resulting two dimensional equations describe the time-space distribution of sediment concentration and transport rate. The process for combining the results for watershed analysis is outlined. W77-00159

**ASSESSMENT OF PRACTICALITY OF REMOTE SENSING TECHNIQUES FOR A STUDY OF THE EFFECTS OF STRIP MINING IN ALABAMA,** Alabama Univ., University. Dept. of Geology and Geography. For primary bibliographic entry see Field 5C. W77-00170

**TRI-STATE CONFERENCE REPORT: METHODS FOR BEACH AND SAND DUNE PROTECTION,** Georgia Dept. of Natural Resources, Atlanta. For primary bibliographic entry see Field 4D.

W77-00193

**CHARACTERISTICS OF NATURALLY OCCURRING AND POLLUTANT HYDROCARBONS IN MARINE SEDIMENTS,** Paris Univ. (France). For primary bibliographic entry see Field 5A. W77-00223

**GEOMORPHOLOGICAL MAPPING APPLIED TO SOIL EROSION EVALUATION,** National Inst. of Agricultural Engineering, Silsoe (England). A. R. Williams, and R. P. C. Morgan. Journal of Soil and Water Conservation, Vol. 31, No. 4, p 164-168, July-August 1976. 3 fig, 20 ref.

Descriptors: \*Geomorphology, \*Mapping, \*Soil erosion, \*Aerial photography, \*Erosion, Photography, Surveys, Grassed waterways, Sediments, Accelerated erosion, Soils, Maps, Evaluation. Identifiers: Soil erosion evaluation, Erosion patterns, Ground surveys, Natural erosion, Mapping procedure, Field surveys, Panchromatic photography.

Aerial photographs provided a base for mapping soil erosion and for evaluating soil erosion hazards. Most soil erosion features were visible in indirect stereoscopic image, and those that were not, could be readily inferred from tonal variations. Compared with ground surveys, use of aerial photographs minimized the time required to produce maps and lowered the cost of surveys. However, no standard technique existed for mapping soil erosion. Different countries developed their own systems of geomorphological survey. Some common features emerged from the profusion of techniques and symbolization that existed. In addition to showing the type, intensity, and location of erosion, the authors' system portrayed information on the spatial distribution of erosivity, runoff, slope length, slope steepness, slope curvature in profile and plan, relief, soil type, and plant cover. Aerial photographs of the same area taken on different dates yielded information on temporal changes in erosion patterns for construction of empirical models. Such studies allowed the evaluation of the effects of changing land use and implementation of conservation work. (Roberts-ISWS) W77-00369

**SOME DIFFERENCES BETWEEN DISTRIBUTING AND BRAIDING CHANNELS,** Macquarie Univ., North Ryde (Australia). School of Earth Sciences. For primary bibliographic entry see Field 2E. W77-00376

**ADJUSTMENT OF STREAM-CHANNEL SHAPE TO HYDROLOGIC REGIME,** Papua and New Guinea Univ., Port Moresby (New Guinea). Dept. of Geography. For primary bibliographic entry see Field 8B. W77-00379

**CHANNEL EROSION SURVEYS ALONG TAPS ROUTE, ALASKA, 1975,** Geological Survey, Anchorage, Alaska. P. F. Doyle, and J. M. Childers. Open-file report (basic data), 1975. 95 p, 52 fig, 1 tab, 4 ref, append.

Descriptors: \*Channel erosion, \*Construction, \*Alaska, \*Pipelines, Channel flow, Streams, Rivers, Data collections, Scour, Aerial photography, Photogrammetry, Channel morphology. Identifiers: \*Trans-Alaska pipeline (Alas).

Channel surveys at 27 sites along the trans-Alaska pipeline route during 1975 documented significant channel changes and identified possible causative

## WATER CYCLE—Field 2

### Chemical Processes—Group 2K

factors. Some of the important findings of the year's surveillance include: 8 feet (2.4 meters) of flood scour measured at the Salcha River crossing site, 180 feet (55 meters) of lateral bank erosion measured over 3 years on the Middle Fork Koyuk River near Coldfoot, and rapid shifting of anabranches on braided stream crossings during high water. Aerial photogrammetric surveys were used for the first time during 1975. Preliminary results show this method is specially suited for surveillance of large braided river channels. (Woodard-USGS)  
W77-00433

**NUTRIENT STATUS OF THE SEDIMENTS IN LAKE MULWALA, I. TOTAL PHOSPHORUS,** Caulfield Inst. of Tech. (Australia). Dept. of Chemistry.  
For primary bibliographic entry see Field 5C.  
W77-00450

**EROSION IN 1973-74: THE RECORD AND THE CHALLENGE,** Soil Conservation Service, Washington, D. C. K. E. Grant.  
Journal of Soil and Water Conservation, Vol. 30, No. 1, p 29-32. January-February, 1975.

Descriptors: \*Erosion, \*Crop production, \*Agriculture, \*Soil conservation.

The 1973-74 growing season in many ways was not a good one for the nation's soil and water resources. Excessive soil erosion from both wind and water accompanied the efforts of many farmers to increase crop production. Contributing to the year's poor record was some of the worst weather in years. But severe erosion could also be traced to the unwise selection of certain soils for cultivated crops as well as the existence of too few conservation measures on the land. (Skogerboe-Colo St)  
W77-00471

**SEDIMENT DISCHARGE IN THE UPPER ARROYO GRANDE AND SANTA RITA CREEK BASINS, SAN LUIS OBISPO COUNTY, CALIFORNIA,** Geological Survey, Menlo Park, Calif. J. M. Knott.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-256 422. Price codes: A03 in paper copy, A01 in microfiche. Water-Resources Investigations 76-64, June 1976. 29 p, 8 fig, 9 tab, 12 ref.

Descriptors: \*Sediment transport, \*Sediment discharge, \*Sediment yield, \*California, River basins, Sediment distribution, Streamflow, Sediment load, Bed load.  
Identifiers: San Luis Obispo County(Calif), \*Upper Arroyo Grande basin(Calif), \*Santa Rita Creek basin(Calif).

Sediment data collected in the upper Arroyo Grande and Santa Rita Creek basins, San Luis Obispo County, California, during the 1968-73 water years were analyzed to determine total sediment discharge at four stations in the basins. Water discharge and total sediment discharge at these stations, representative of the 1943-72 period, were estimated from long-term flow data for nearby gaging stations and water-sediment discharge relations determined for the 1968-73 water years. Most of the total annual sediment discharge at each station occurs during a few days each year. The quantity of sediment transported in a single day often accounts for more than 40 percent of the total annual sediment discharge. Estimated sediment discharge for the upper Arroyo Grande and Santa Rita Creek basins during the 1943-72 water years averaged 53,000 tons and 23,000 tons per year. Long-term sediment deposition in Lopez Reservoir, which is in the southern part of the upper Arroyo Grande basin, was esti-

mated to be 35 acre-feet per year. (Woodard-USGS)  
W77-00487

**AN OVERVIEW OF URBAN SEDIMENTOLOGY,** Geological Survey, Reston, Va.  
For primary bibliographic entry see Field 4C.  
W77-00491

**QUALITATIVE COMPOSITION OF THE SUSPENDED SEDIMENTS OF THE ORDZHONIKIDZE IRRIGATION SYSTEM, (IN RUSSIAN),** T. A. Mamedova.  
Izv Akad Nauk Az SSR Ser Biol Nauk. 4, p 53-57, 1974.

Descriptors: Irrigation systems, \*Turbidity, \*Suspended solids, \*Particle size, \*Nutrients, \*Water quality, \*Sierozems, \*Fertilization, Canals, \*Irrigation canals, \*Sediments, Irrigation water, Distribution.  
Identifiers: Ordzhonikidze canal(USSR), \*USSR.

The Ordzhonikidze canal in the Azerbaijan SSR (USSR) originates from the Araks River and runs 64 km southwestward through the Mil'skii steppe, irrigating an area of 73,000 ha. Data are presented on the turbidity of the irrigation waters and particle-size distribution and chemical composition of the suspended sediments of the system. The suspended sediments of the system are nutrient rich and play an important role in the fertility of the irrigated sierozem soils.—Copyright 1975, Biological Abstracts, Inc.  
W77-00497

**STUDY OF THE EROSION STABILITY OF THE FLOW LAYERS OF GRAY FOREST SOILS OF THE NORTHERN FOREST-STEPPE, (IN RUSSIAN),** Moscow State Univ. (USSR). Dept. of Soil Physics and Reclamation.  
For primary bibliographic entry see Field 4D.  
W77-00514

## 2K. Chemical Processes

**DYNAMICS OF THE COMPOSITION AND THE QUALITIES OF WATER-SOLUBLE ORGANIC SUBSTANCE DURING THE COMPOSTING OF CLOVER AND TIMOTHY ROOTS, (IN RUSSIAN),** Leningrad State Univ. (USSR)  
For primary bibliographic entry see Field 5B.  
W77-00062

**RETENTION OF ARSENIC BY HYDROXY-ALUMINUM ON SURFACES OF MICACEOUS MINERAL COLLOIDS,** Saskatchewan Univ., Saskatoon. Dept. of Soil Science.  
For primary bibliographic entry see Field 5B.  
W77-00283

**A PROCEDURE FOR THE SAMPLING AND TESTING OF LARGE SOIL CORES,** New South Wales Univ., Kensington (Australia). Dept. of Civil Engineering.  
For primary bibliographic entry see Field 2G.  
W77-00286

**CHEMICAL WEATHERING OF GLAUCONITE,** Tripoli Univ., Libya. Dept. of Soil and Water Sciences.  
G. Abudelgawad, A. L. Page, and L. J. Lund. Soil Science Society of America Proceedings, Vol. 39, No. 3, p 567-571, May-June 1975. 3 fig, 2 tab, 26 ref.

Descriptors: \*Chemical reactions, \*Geologic investigations, Geological surveys, Geochemistry, Sampling, Limestone, X-ray diffraction, Mineralogy.  
Identifiers: \*Glauconite, \*Chemical weathering, Barce Plateau(Libya).

Glauconite samples were collected from geologic cuts in the Barce Plateau in the eastern part of Libya. The glauconite was associated with limestone, dolomitic limestone, marl, marl stone, chert, and kaolinite. Samples of the glauconite from the area of study after removal of carbonates gave X-ray diffraction spacings of 10.0, 7.2, 5.0, 3.6 and 3.3 Angstroms. Spacings of 10.0, 5.0, and 3.3 Angstroms represent the 001, 002, and 003 reflection of micaceous components. Spacings of 7.2 and 3.6 Angstroms were due to kaolinite. No 060 reflection was observed for random samples. The absence of this spacing, although not entirely specific for glauconite, is indicative of glauconite-like minerals. Petrographic analysis and chemical composition confirmed that the micaceous mineral studied was glauconite. (Skogerboe-Colo St)  
W77-00289

**THE ACTIVITY CONCEPT OF PHOSPHATE-ROCK SOLUBILITY,** International Fertilizer Development Center, Florence, Ala. S. H. Chien, and C. A. Black.  
Soil Science Society of America Proceedings, Vol. 39, No. 5, p 856-858, September-October 1975. 4 fig, 11 ref.

Descriptors: \*Phosphates, \*Soil chemistry, Soil investigations, Chemical reactions, Florida, Geochemistry.  
Identifiers: \*Phosphorite, \*Florida phosphate rock.

Various treated samples of a finely ground Florida phosphate rock were equilibrated with dilute HCl solutions, and the ion-activity product of the carbonate apatite mineral in the phosphate rock was then determined from analyses made on the solutions. Constant ion-activity products or solubility-product constants were found within a certain pH range in each instance. The solubility, as reflected by the numerical value of the constant, decreased with an increase in the proportion of the phosphate rock dissolved in the solubility determination or prior thereto. After a certain portion of the phosphate rock had been dissolved, however, no further decrease in solubility was found with further extraction of the phosphate rock. These results are similar to those obtained previously with synthetic hydroxylapatite and were interpreted in the same way, namely, that the solids are not uniform but exist in a range of activities. (Skogerboe-Colo St)  
W77-00290

**THE MECHANISM OF PHOSPHATE FIXATION BY IRON OXIDES,** Griffith Univ., Nathan, (Australia). R. L. Parfitt, R. J. Atkinson, and R. St. C. Smart.  
Soil Science Society of America Proceedings, Vol. 39, No. 5, p 837-841, September-October 1975. 6 fig, 1 tab, 12 ref.

Descriptors: \*Iron oxides, \*Iron, \*Phosphates, Soil chemistry, Soil investigations, Chemical reactions, Infrared spectroscopy, Geochemistry.  
Identifiers: \*Infrared spectroscopy, \*Phosphate fixation.

Infrared spectroscopic techniques have been used to obtain a structural model for the surface reaction between iron oxides and phosphate ions. Two surface hydroxyl ions (or water molecules) are replaced by one phosphate ion. Two of the oxygen atoms of the phosphate ion are coordinated, each to a different Fe<sup>3+</sup> ion, resulting in a binuclear surface complex of the type Fe-O-P(O)<sub>2</sub>-O-Fe. Evidence is given for phosphate adsorption

## Field 2—WATER CYCLE

### Group 2K—Chemical Processes

producing this coordination structure on the surfaces of goethite, hematite, lepidocrocite, beta-ferric hydroxide, and amorphous ferric hydroxide gel. (Skogerboe-Colo St)  
W77-00291

**DENITRIFICATION RATES IN RELATION TO TOTAL AND EXTRACTABLE SOIL CARBON,**  
Agricultural Research Service, Beltsville, Md.  
For primary bibliographic entry see Field 2G.  
W77-00294

**SODIUM AVAILABILITY IN NONALKALI SOILS,**  
Iowa State Univ., Ames. Dept. of Agronomy.  
For primary bibliographic entry see Field 2G.  
W77-00296

**TOTAL NITROGEN USING A SODIUM HYDROXIDE INDEX AND DOUBLE SAMPLING THEORY,**  
Forest Service (USDA), La Grande, Oreg. Pacific Northwest Forest and Range Experiment Station.  
For primary bibliographic entry see Field 2G.  
W77-00297

**A NEW TECHNIQUE FOR RAPID AND CONTINUOUS MEASUREMENT OF REDOX POTENTIALS,**  
Lockheed Missiles and Space Co., Sunnyvale, Calif.  
For primary bibliographic entry see Field 2G.  
W77-00299

**USE OF AMMONIA ELECTRODE FOR DETERMINATION OF CATION EXCHANGE CAPACITY IN SOIL STUDIES,**  
Iowa State Univ., Ames. Dept. of Soil Science.  
For primary bibliographic entry see Field 2G.  
W77-00300

**THE IMPACT OF MAN ON THE WORLD NITROGEN CYCLE,**  
Purdue Univ., Lafayette. Dept. of Agricultural Economics.  
For primary bibliographic entry see Field 5A.  
W77-00312

**THE SPECTROPHOTOMETRIC DETERMINATION OF ARSENIC IN SEA WATER, POTABLE WATER, AND EFFLUENTS,**  
Liverpool Univ. (England). Dept. of Oceanography.  
For primary bibliographic entry see Field 5A.  
W77-00319

**RE-ASSESSMENT OF CHELATING ION-EXCHANGE RESINS FOR TRACE METAL ANALYSIS OF SEA WATER,**  
Liverpool Univ. (England). Dept. of Oceanography.  
For primary bibliographic entry see Field 5A.  
W77-00320

**THE DETERMINATION OF ZINC, CADMIUM, LEAD AND COPPER IN A SINGLE SEA-WATER SAMPLE BY DIFFERENTIAL PULSE ANODIC STRIPPING VOLTAMMETRY,**  
Liverpool Univ. (England). Dept. of Oceanography.  
For primary bibliographic entry see Field 5A.  
W77-00321

**STATE OF WISCONSIN AUTOMATIC WATER QUALITY MONITORING SYSTEM FOR THE FOX AND WISCONSIN RIVERS,**  
Wisconsin Dept. of Natural Resources, Wisconsin Rapids.  
For primary bibliographic entry see Field 5A.

W77-00334

**CHEMILUMINESCENCE METHOD OF DETERMINING COPPER IN NATURAL WATERS, (IN RUSSIAN),**  
Akademiya Nauk URSR, Kiev. Institut Hidrobiologii.  
For primary bibliographic entry see Field 5A.  
W77-00404

**HYDROGEOCHEMICAL INVESTIGATION OF THE DANUBE WATER IN AUSTRIA DURING THE YEARS 1971 AND 1972, (IN GERMAN),**  
Bundesversuchs- und Forschungsanstalt Arsenal, Vienna (Austria).  
For primary bibliographic entry see Field 5A.  
W77-00406

**SUITABILITY OF CONTAINERS FOR STORAGE OF WATER SAMPLES,**  
Australian Mineral Development Labs., Adelaide.  
For primary bibliographic entry see Field 5A.  
W77-00436

**STOICHIOMETRIC DISTANCE AND TOTAL CONCENTRATION: A BINARY NUMERICAL DESCRIPTION OF INLAND WATER CHEMISTRY,**  
Tasmania Univ., Hobart (Australia). Dept. of Botany.  
R. T. Buckney.  
Australian Journal of Marine and Freshwater Research, Vol. 27, No. 1, p 73-81, March 1976. 7 fig., 21 ref.

Descriptors: \*Data processing, \*Water chemistry, \*Ions, \*Surface waters, \*Australia, Analytical techniques, Salinity, Hydrogen ion concentration, Silica, Potassium, Sodium, Calcium, Magnesium, Chlorides, Sulfates, Carbonates, Pollutant identification.  
Identifiers: \*Tasmania.

A method is presented by which analytical data for major ions in water may be simply presented by means of two parameters - a 'total concentration' parameter based on the total anion equivalent concentration, and a 'stoichiometric distance' parameter which expresses the relative concentrations of the major ions in the water by reference to the relative ion composition of seawater. The ions considered are those of potassium, sodium, calcium and magnesium; chloride, sulfate and carbonate-bicarbonate. The system is used to describe some features of inland waters of Tasmania (Australia), and equilibrium and other controls on pH and silica concentration are noted. Since this particular analysis is based on the observed range of ionic proportions in Tasmania, its conclusions may not be directly applicable elsewhere; but it has facilitated the identification of features which might occur more widely. (CSIRO)  
W77-00449

**HYDROGEOCHEMISTRY OF THE GENOA RIVER BASIN, NEW SOUTH WALES - VICTORIA (AUSTRALIA),**  
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Environmental Marine Geology.  
G. E. Reinson.  
Australian Journal of Marine and Freshwater Research, Vol 27, No 1, p 165-186, March 1976. 9 fig, 5 tab, 22 ref.

Descriptors: \*Granites, \*Weathering, \*River basins, \*Water chemistry, \*Australia, Rock properties, Water types, Salinity, Watersheds(Basins), Calcium, Magnesium, Sodium, Bicarbonates, Chlorides, Salt balance, Surface waters, Pollutant identification.  
Identifiers: Genoa River(NSW-Vic).

Two main chemical types of surface water are identified within the basin: a sodium-chloride type and a mixed-cation chloride-bicarbonate type. The genesis of the types is related to differences in the weathering rates of the granitoid rocks underlying the basin. Readily weathered rock suites yield minerals which supply calcium, magnesium, sodium and bicarbonates to the water draining them (mixed cation type), while where chemical rock weathering is slow, the surface water chemistry is dominated by atmospheric salts (sodium chloride type). This difference remains the controlling factor in the genesis of the two water types even during low runoff periods when the groundwater contribution to streamflow and the rate of evaporation are high. (CSIRO)  
W77-00452

**IDENTIFICATION AND ANALYSIS OF ORGANIC POLLUTANTS IN WATER,**  
Environmental Protection Agency, Athens, Ga. Southeast Environmental Research Lab.  
For primary bibliographic entry see Field 5A.  
W77-00455

## 2L. Estuaries

**CAPACITY OF A SPARTINA SALT MARSH TO ASSIMILATE NITROGEN FROM SECONDARILY TREATED SEWAGE,**  
Georgia Univ., Sapelo Island. Marine Inst.  
For primary bibliographic entry see Field 5B.  
W77-00003

**ENGINEERING STUDY AND FIELD DEMONSTRATION TRIALS FOR SAND DUNE STABILIZATION,**  
Ward (George D.) and Associates, Portland, Oreg.  
For primary bibliographic entry see Field 5E.  
W77-00032

**ASSOCIATIONS OF CHLORINATED HYDROCARBONS WITH FINE PARTICLES AND HUMIC SUBSTANCES IN NEARSHORE SURFICIAL SEDIMENTS,**  
University of Southern California, Los Angeles. Environmental Engineering Program.  
For primary bibliographic entry see Field 5A.  
W77-00086

**A CONCEPTUAL MODEL OF OFFSHORE PERMAFROST,**  
Alaska Univ., College. Geophysical Inst.  
For primary bibliographic entry see Field 2C.  
W77-00094

**TRIESTE-WATER LEVELS 1952-1971; A STUDY OF THE TIDE, MEAN LEVEL, AND SEICHE ACTIVITY,**  
Department of the Environment, Ottawa (Ontario). Marine Environmental Data Service.  
G. Godin, and L. Trotti.  
Miscellaneous Special Publication 28, 1975. 24 p, 17 fig, 14 tab, 29 ref.

Descriptors: \*Water levels, \*Tides, \*Variability, \*Seiches, Waves, Gaging stations, Gages, Measurement, Data processing, Analytical techniques, Fourier analysis, Sampling, Estuaries, Harbors, Oceanography.  
Identifiers: \*Trieste, \*Italy.

A sequence of observations on the water level at Trieste covering the interval 1952-71 was submitted to a general analysis. The sequence was divided into sub-sequences of observations of a duration of 355 days to follow the evolution of these sub-sequences. Three factors affected the water level at Trieste: (1) the tide, (2) slow variations, and (3) transient oscillations due to storms which were made evident by seiches or sudden jumps in



level. The study of the tide was effected with the help of sample Fourier spectra, which aided recognition and identification of the tidal constituents. This identification was checked by the evolution of the Greenwich phase lag from sample to sample. If it showed a long-term trend, the identification of the constituent was erroneous, and it was necessary to search for a similar or neighboring constituent which could explain the same peak. A rather reliable list of constituents of the tide at Trieste was set up which seemed to vary little from year to year. An increase in the phases during 3 consecutive years could be attributed to a gradual obstruction of the stiling well. On the other hand, the mean level, obtained from a low-pass filter, showed strong and often prolonged variations during the fall and winter and yielded to an explanation only after a deeper study of their physical causes. Power spectra of the same low passes were computed with the hope that they would help explain this type of variation. The difference between the observed level and the predicted tide made up what is called a 'residue': it reflected all the phenomena which did not have the regularity of the tide. The plot of these residues from month to month allowed a rapid inspection of all that seemed to exceed the norms, and the months during which important transients occurred were set aside for a closer look. In this way, incidents of oscillation caused by the great Adriatic seiche of a period of 22 h, very near to that of the diurnal tide, and abrupt changes in level caused by a rapid transition from a regime of sirocco to the bora or to a frontal passage could be isolated. (Sims-ISWS)

W77-00128

#### NUMERICAL SIMULATION OF THE ARCTIC OCEAN CIRCULATION

California Univ., Los Angeles. Dept. of Meteorology.

A. J. Semtner, Jr.  
Journal of Physical Oceanography, Vol. 6, No. 4, p 409-425, July 1976. 22 fig, 2 tab, 35 ref.

Descriptors: \*Model studies, \*Ocean circulation, \*Arctic Ocean, \*Mathematical models, Water circulation, Oceans, Winds, Temperature, Water temperature, Salinity, Atmospheric pressure, Currents(Water), Circulation, Simulation analysis, Oceanography.  
Identifiers: \*Greenland Sea.

The circulation of the Arctic Ocean and Greenland Sea was simulated using the 1969 numerical model of Bryan and Cox. The coastline and bottom topography of the region were resolved by a 110 km horizontal grid spacing and by 14 vertical levels. The transfers of mass, heat, and momentum at the ocean surface and at open lateral boundaries were specified from observations. In particular, the pattern of wind stress was obtained using a map of mean annual atmospheric pressure; and a scalar multiplier was applied to account for the nonlinear dependence of stress on wind speed. Three experiments with different values of this scalar multiplier were run to simulate the effect of high, medium, and low wind stress. Many of the observed features of the Arctic circulation were reproduced by the simulation. The observed features were: the Greenland Sea exhibits cyclonic flow at all levels and deep convection in its central region. The Beaufort Sea shows anti-cyclonic flow at the surface and a stable stratification maintained by a halocline. The Arctic Ocean receives bottom water and an intermediate layer of warm Atlantic water through the Greenland-Spitsbergen Passage, and its exports surface water of low salinity into an intense East Greenland Current. The sense of circulation of the Atlantic layer in the central Arctic Ocean, although opposite to that usually inferred from water mass properties, seems to be in reasonable agreement with existing direct current measurements. (Sims-ISWS)

W77-00129

#### ON FORCED, LONG CONTINENTAL SHELF WAVES ON AN F-PLANE

Oregon State Univ., Corvallis. School of Oceanography.  
J. S. Allen.

Journal of Physical Oceanography, Vol. 6, No. 4, p 426-431, July 1976. 5 ref. NSF DES75-15202, NSF IDO71-04211, NSF OCE76-00596.

Descriptors: \*Model studies, \*Ocean waves, \*Continental shelf, \*Continental slope, Waves(Water), Ocean circulation, Mathematical models, Coriolis force, Fluid mechanics, Shores, Coasts, Internal waves, Mathematics, Equations, Computer models, Oceanography.  
Identifiers: \*Continental shelf waves, f-Plane waves.

Previous studies of forced, long continental shelf waves on an f-plane have considered motion on the shelf and slope which is driven by an alongshore component of the wind stress, essentially through the suction of fluid into the surface layer at the coast. These studies have utilized a boundary condition, which arises consistently in the longwave nondispersive limit for free shelf waves, that at the slope-interior junction the alongshore velocity component is approximately equal to zero. This is an extremely useful condition for problems concerning forced motion on the shelf and slope because it completely uncouples the motion in this region from that in the interior, and it allows the shelf-slope problem to be solved independently of the interior problem. It was shown, however, that this condition is not correct in general for wind-stress-forced f-plane motion. A proper formulation of the f-plane, forced shelf wave problem in the long wave limit was presented. The motion on the shelf and slope, in general, was coupled with and forced by the flow in the interior. (Sims-ISWS)

W77-00131

#### THE TRANSMISSION AND DECAY OF BAROTROPIC TOPOGRAPHIC ROSSBY WAVES INCIDENT ON A CONTINENTAL SHELF

Nova Univ., Fort Lauderdale, Fla.  
J. Kroll, and P. P. Niiler.

Journal of Physical Oceanography, Vol. 6, No. 4, p 432-450, July 1976. 21 fig, 10 ref. NSF GA-34149.

Descriptors: \*Model studies, \*Ocean waves, \*New England, \*Florida, \*Continental shelf, Waves(Water), Ocean circulation, Mathematical models, Coriolis force, Fluid mechanics, Shores, Coasts, Topography, Mathematics, Equations, Computer models, Oceanography.  
Identifiers: \*Continental shelf waves, Barotropic waves, Topographic waves, Rossby waves.

It is known that long-period (greater than 1 day) and long-wavelength (greater than 100 km) topographical Rossby waves can be generated by a wind acting directly on a continental shelf. The characteristics of these waves, which can also be produced off the shelf by wind and current eddies and can propagate up to and onto the shelf, were examined. A shelf model was used which varied in depth in one direction only, and it was assumed that a shelf can be approximated by at most two breaks with the depth varying exponentially. Also assumed was velocity-dependent bottom friction to determine the effect of frictional dissipation. The following results were derived: The regression angle of scatter plots for topography-dominated waves should be small, and the preponderant direction of the waves determined by the sign. The group velocity directed up the slope possesses an absolute maximum which occurs at a relatively short period. The ability of a wave moving up a slope to overcome friction correlates with this group velocity. The energy flux transmission across one and two breaks can be determined. It was suggested that the product of this flux transmission coefficient and the group velocity component up the shelf be the criterion to determine

which wavelengths and frequencies penetrate nearest to shore. It was found, however, that the energy from off the shelf is likely to be decayed completely in bottom depths less than about 25 m. A comparison of some results with data for the New England and west Florida shelf showed a general agreement. (Sims-ISWS)

W77-00132

#### CONTINENTAL SHELF WAVES IN THE FLORIDA STRAITS

Kiel Univ. (West Germany). Institut fuer Meereskunde.  
F. Schott, and W. Duing.

Journal of Physical Oceanography, Vol. 6, No. 4, p 451-460, July 1976. 8 fig, 3 tab, 19 ref, 3 append. ONR N0001475-C-0173.

Descriptors: \*Ocean waves, \*Continental shelf, \*Currents(Water), \*Florida, Topography, Water circulation, Ocean circulation, Waves(Water), On-site investigations, Current meters, Data processing, Analytical techniques, Wavelengths, Oceanography.  
Identifiers: \*Florida Straits, \*Gulf Stream, Continental shelf waves, Barotropic waves, Wave propagation.

Current measurements from three stations along the east coast of Florida at about 300 m water depth with a maximum longshore separation of 180 km were used to analyze for the presence of propagating waves. The analysis was done by solving the inverse problem of determining the most likely wave parameters from 36 independent auto spectra and cross spectra from four current meters. For the 10-13 day band, a significant fit of the data by wave cross-spectral function was found. The wavelength was 170 km and the phase propagation 17 cm/s toward the south. The current fluctuations were elliptically polarized with anticyclonic rotation and with an axis ratio of 0.30. The mean current amplitude was 14.3 cm/s. A marginally significant fit with similar wave parameters resulted for the 7-10 day band. The results suggested that these waves were continental shelf waves, probably generated by atmospheric cold front passages. (Sims-ISWS)

W77-00133

#### ON THE FLOW THROUGH BARROW CANYON

Washington Univ., Seattle. Dept. of Oceanography.  
D. G. Mountain, L. K. Coachman, and K. Aagaard.

Journal of Physical Oceanography, Vol. 6, No. 4, p 461-470, July 1976. 12 fig, 1 tab, 9 ref. ONR N00014-67-A-0103-0014, ONR N00014-A-0103-0021.

Descriptors: \*Flow, \*Ocean currents, \*Alaska, \*Arctic Ocean, Surveys, Measurement, Current meters, Temperature, Salinity, Winds, Model studies, Mathematical models, Dynamics, Fluid mechanics, Oceanography.  
Identifiers: \*Barrow Canyon, \*Bering Strait, \*Chukchi Sea.

Simultaneous current and temperature measurements were made at two depths in Barrow Canyon for a period of 120 days from April through August, 1973. The mean of the measured currents was 25 cm/s toward the northeast, such that water moved out of the canyon from the Chukchi Sea toward the Arctic Ocean. The measurements, however, were characterized by higher speeds, commonly in excess of 50 cm/s, and large variations which resulted in periods of reversed (southwest) up-canyon motion. During these reversed flow periods, increased temperature indicated the presence in the canyon at 126 m depth of Atlantic water from 200-300 m depth in the Arctic Ocean. A close relationship existed between the measured currents and the north-south atmospheric pressure gradient, such that when the

## Field 2—WATER CYCLE

### Group 2L—Estuaries

pressure rose to the north, the northward flow of water through the canyon decreased. A simple dynamic model was presented to account for the observed current-pressure relationship. (Sims-ISWS)  
W77-00134

**GEOGRAPHICAL VARIABILITY OF THE INTERNAL WAVE FIELD: A SEARCH FOR SOURCES AND SINKS,**  
Massachusetts Inst. of Tech., Cambridge. Dept. of Earth and Planetary Sciences.  
C. Wunsch.  
Journal of Physical Oceanography, Vol. 6, No. 4, p 471-485, July 1976. 13 fig, 20 ref. ONR N00014-75-C-0291, NSF IDO75-03998.

Descriptors: \*Internal waves, \*Atlantic Ocean, \*Ocean waves, On-site investigations, Surveys, Current meters, Data processing, Analytical techniques, Topography, Bathymetry, Equations, Energy, Dynamics, Waves(Water), Ocean currents, Currents(Water), Model studies, Mathematical models, Oceanography.  
Identifiers: \*Muir Seamount, \*Gulf Stream.

Internal wave records from a variety of deep water locations in the North Atlantic have been reduced by common analysis methods in a search for systematic deviations from a universal spectral model. It was speculated that such inhomogeneities are probably necessary conditions for sources and sinks of the motion. For a number of reasons, only records at 2000 m and below were used. Real variations in energy level of up to an order of magnitude were found, but the only clear inhomogeneities were associated with bottom topography, especially in those records obtained near Muir seamount. The effects, if any, on the internal wave field by the large velocity and shear of the Gulf Stream region were weak. Apparent topographic sources were inconspicuous at very short distances, suggesting a very rapid, nonlinear recovery of the spectrum to an equilibrium form. (Sims-ISWS)  
W77-00135

**DETERMINATION OF LAGRANGIAN DEFORMATIONS FROM ANALYSIS OF CURRENT FOLLOWERS,**  
State Univ. of New York at Stony Brook. Marine Sciences Research Center.  
A. Okubo, C. C. Ebbsmeyer, and J. M. Helseth.  
Journal of Physical Oceanography, Vol. 6, No. 4, p 524-527, July 1976. 10 ref. NOAA 6108A, ONR N-00014-67-A-0103-0014.

Descriptors: \*Data processing, \*Analytical techniques, \*Currents(Water), Drift bottles, Deformation, Velocity, Water circulation, Oceans, Mathematical studies, Current meters, Equations, Oceanography.  
Identifiers: \*Lagrangian deformations.

Methods were presented to determine Lagrangian deformations and turbulence statistics from current followers (drogues, neutrally buoyant floats, etc.). Such determinations allowed general advection-diffusion equations to be directly evaluated. Methods were also presented to transform these deformations into oceanic velocity gradients. (Sims-ISWS)  
W77-00136

**SEA SURFACE TEMPERATURE FLUCTUATIONS AT TIDAL FREQUENCIES AT WEATHER SHIPS CHARLIE AND DELTA,**  
McGill Univ., Montreal (Quebec).  
T. Jakobsen.  
Journal of Physical Oceanography, Vol. 6, No. 4, p 602-605, July 1976. 2 fig, 1 tab, 13 ref.

Descriptors: \*Water temperature, \*Atlantic Ocean, \*Tidal effects, \*Weather data, Temperature, Oceans, Tides, Stations, Fluctuations,

Frequency, Internal waves, Topography, Data processing, Frequency analysis, Oceanography.  
Identifiers: \*Sea surface temperature, Spectral analysis.

Data consisting of three years of 3 h surface observations at North Atlantic ocean weather stations Charlie and Delta were analyzed by spectral analysis. Sea surface temperature variations at higher frequencies were examined in detail and some related to tidal frequencies. These occurred at Charlie. The absence of similar fluctuations at Delta was explained by the station's proximity to an amphidromic point in the North Atlantic tidal system. (Sims-ISWS)  
W77-00137

**TEMPERATURE-SALINITY CURVES IN THE PACIFIC AND THEIR APPLICATION TO DYNAMIC HEIGHT COMPUTATION,**  
Hawaii Univ., Honolulu. Dept. of Oceanography.  
W. J. Emery, and R. T. Wert.  
Journal of Physical Oceanography, Vol. 6, No. 4, p 613-617, July 1976. 3 fig, 8 ref.

Descriptors: \*Temperature, \*Salinity, \*Pacific Ocean, \*Oceans, Water properties, Chemical properties, Sea water, Water temperature, Physical properties, Hydrography, Oceanography.  
Identifiers: \*Temperature-salinity curves, \*Temperature-salinity dynamic height.

Mean temperature-salinity (TS) curves were computed from all available hydrographic data from 10 deg quadrangles in the Pacific between 20 deg S and 40 deg N. These curves, together with temperature profiles from hydrographic stations, were used to compute a quantity called TS dynamic height. The rms differences between dynamic and TS dynamic height indicated where mean TS curves might be reliably used to compute dynamic height from temperature profiles. (Sims-ISWS)  
W77-00138

**A FOUR-YEAR ANALYSIS OF VEGETATION FOLLOWING AN OIL SPILL IN A FRESH-WATER MARSH,**  
Smith Coll., Northampton, Mass. Dept. of Biological Sciences.  
For primary bibliographic entry see Field 5C.  
W77-00147

**SURFACE NUTRIENTS, CHLOROPHYLL-A AND PHAEOPIGMENT IN SOME SCOTTISH SEA LOCHS,**  
Dunstaffnage Marine Research Lab., Oban (Scotland).  
For primary bibliographic entry see Field 5C.  
W77-00182

**COMPOSITIONAL CHANGES OF A FUEL OIL FROM AN OIL SPILL DUE TO NATURAL EXPOSURE,**  
McGill Univ., Montreal (Quebec). Dept. of Civil Engineering and Applied Mechanics.  
For primary bibliographic entry see Field 5B.  
W77-00183

**EFFECTS OF OIL ON THE REPRODUCTION OF THE AMPHIPOD GAMMARUS OCEANICUS,**  
Swedish Water and Air Pollution Research Lab., Nykoping. Baltic Sea Lab.  
For primary bibliographic entry see Field 5C.  
W77-00188

**TRI-STATE CONFERENCE REPORT: METHODS FOR BEACH AND SAND DUNE PROTECTION,**  
Georgia Dept. of Natural Resources, Atlanta.  
For primary bibliographic entry see Field 4D.  
W77-00193

**THE BENTHIC ECOLOGY OF LOCH LINNHE AND LOCH EIL, A SEA-LOCH SYSTEM ON THE WEST COAST OF SCOTLAND. IV. CHANGES IN THE BENTHIC FAUNA ATTRIBUTABLE TO ORGANIC ENRICHMENT,**  
Dunstaffnage Marine Research Lab., Oban (Scotland).  
For primary bibliographic entry see Field 5C.  
W77-00196

**LOS ANGELES HARBOR FIELD INVESTIGATION OF OIL AND BACKGROUND LUMINESCENCE SIGNATURES,**  
McDonnell Douglas Astronautics Co., Huntington Beach, Calif.  
For primary bibliographic entry see Field 5A.  
W77-00197

**THE USE OF ERTS-1 TO MORE FULLY UTILIZE AND APPLY MARINE STATION DATA TO THE STUDY AND PRODUCTIVITY ALONG THE EASTERN SHELF WATERS OF THE UNITED STATES,**  
Old Dominion Univ. Research Foundation, Norfolk, Va.  
For primary bibliographic entry see Field 5A.  
W77-00198

**REMOTE SAMPLER FOR DETERMINING RESIDUAL OIL CONTENT OF SURFACE WATERS,**  
Naval Ship Research and Development Center, Annapolis, MD.  
For primary bibliographic entry see Field 5A.  
W77-00216

**OIL SPILL-SOURCE CORRELATION BY GAS CHROMATOGRAPHY: AN EXPERIMENTAL EVALUATION OF SYSTEM PERFORMANCE,**  
Woods Hole Oceanographic Institution, Mass.  
For primary bibliographic entry see Field 5A.  
W77-00218

**THE ISOLATION AND CHARACTERIZATION OF HYDROCARBON-UTILIZING BACTERIA FROM CHEDABUCTO BAY, NOVA SCOTIA,**  
Rhode Island Univ., Kingston. Dept. of Plant Pathology-Entomology.  
For primary bibliographic entry see Field 5A.  
W77-00244

**PREDICTION OF OIL SLICK MOTIONS IN NARRAGANSETT BAY,**  
Rhode Island Univ., Kingston. Dept. of Mechanical Engineering and Applied Mechanics.  
For primary bibliographic entry see Field 5B.  
W77-00253

**CODES OF PRACTICE FOR DEALING WITH OIL SPILLS AT SEA AND ON SHORE: A EUROPEAN VIEW**  
Institute of Petroleum, London (England).  
For primary bibliographic entry see Field 5G.  
W77-00262

**USE OF THE MASSACHUSETTS DIP OIL SKIMMER ON FREE SLICKS IN THE CASCO BAY (PORTLAND) SPILL,**  
JBF Scientific Corp., Burlington, Mass.  
For primary bibliographic entry see Field 5G.  
W77-00265

**A STUDY OF THE EFFECTS OF THE SAN FRANCISCO OIL SPILL ON MARINE ORGANISMS,**  
College of Marin, Kentfield, Calif.  
For primary bibliographic entry see Field 5C.  
W77-00270



**THE PHYSICAL OCEANOGRAPHY AND WATER QUALITY OF NEW YORK HARBOR AND WESTERN LONG ISLAND SOUND.**  
State Univ. of New York at Stony Brook. Marine Sciences Research Center.  
For primary bibliographic entry see Field 5G.  
W77-00273

**CHROMOSOME MUTAGENESIS IN DEVELOPING MACKEREL EGGS SAMPLED FROM THE NEW YORK BIGHT.**  
National Oceanic and Atmospheric Administration, Boulder, Colo. Marine Ecosystems Analysis Program Office.  
For primary bibliographic entry see Field 5C.  
W77-00274

**COASTAL ZONE BIBLIOGRAPHY: CITATIONS TO DOCUMENTS ON PLANNING, RESOURCES MANAGEMENT AND IMPACT ASSESSMENT, SECOND EDITION.**  
California Univ., San Diego, La Jolla. Inst. of Marine Resources.  
B. Jenks, J. Sorensen, and J. Breadon.  
Sea Grant Publication No. 49, IMR Ref. No. 76-8, June 1976. 174 p, 1701 ref. NOAA Sea Grant 04-5-158-20.

Descriptors: \*Coasts, \*Bibliographies, \*Estuaries, \*Resources development, \*Coastal marshes, \*Environmental effects, Management, Planning, Water resources, Land use, Conservation.  
Identifiers: \*Coastal zone management, \*Environmental impact.

This second edition of the bibliography contains 1701 references to publications dealing with resources management and impact assessment of the coastal zone. The documents which have been included are primarily monographs. Only a few journal or periodical articles have been included. (NOAA)  
W77-00277

**UNITED STATES COAST PILOT 4 - ATLANTIC COAST FROM CAPE HENRY TO KEY WEST.**  
National Ocean Survey, Rockville, Md.  
For primary bibliographic entry see Field 4A.  
W77-00278

**UNITED STATES COAST PILOT 5 - ATLANTIC COAST FROM GULF OF MEXICO, PUERTO RICO, AND VIRGIN ISLANDS.**  
National Ocean Survey, Washington, D.C.  
For primary bibliographic entry see Field 4A.  
W77-00279

**EFFECTS ON COMMERCIAL FISHING OF PETROLEUM DEVELOPMENT OFF THE NORTHEASTERN UNITED STATES.**  
Woods Hole Oceanographic Institution, Mass. Marine Policy and Ocean Management Program.  
For primary bibliographic entry see Field 5C.  
W77-00280

**CHLORINATED HYDROCARBON PESTICIDES IN WESTERN NORTH ATLANTIC OCEAN.**  
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.  
For primary bibliographic entry see Field 5B.  
W77-00325

**KLEBSIELLA DENSITIES IN WATERS RECEIVING WOOD PULP EFFLUENTS.**  
Environmental Protection Agency, Dauphin Island, Ala. Gulf Coast Water Supply Research Lab.  
For primary bibliographic entry see Field 5C.  
W77-00337

**BIBLIOGRAPHY ON TIDAL HYDRAULICS, SUPPLEMENTARY MATERIAL COMPILED FROM MAY 1971 TO MAY 1974, ES 816, TIDAL FLOWS IN RIVERS AND HARBORS.**  
Committee on Tidal Hydraulics (Army), Washington, D.C.  
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A013 082. Price codes: A11 in paper copy, A01 in microfiche. Report No. 2, Supplement No. 7, June 1975. 241 p.

Descriptors: \*Information exchange, \*Reviews, \*Publications, \*Bibliographies, Theoretical analysis, Sedimentation, Water pollution, Regulation, Salinity, Laboratory tests, Instrumentation, Surveys, Surveying instruments, Data collections, Tidal streams, Tidal waters, Hydraulics, Tides, Estuaries, Currents(Water).

The bibliography consisted of 670 references divided into eight sections: (1) theoretical considerations, (2) sedimentation, (3) salinity effects, (4) contamination, (5) regulation and improvement, (6) laboratory experiments, (7) surveys and instruments, and (8) basic physical data. The references were arranged alphabetically by authors' names within each section, and all references were annotated. Copies of the papers listed are available through loan within the continental United States. (Froehlich-ISWS)  
W77-00353

**SEABED DRIFTER MOVEMENT IN SAN DIEGO BAY AND ADJACENT WATERS.**  
Naval Undersea Center, San Diego, Calif.  
For primary bibliographic entry see Field 5B.  
W77-00356

**PROJECT FOG DROPS V - TASK I: A NUMERICAL MODEL OF ADVECTION FOG, TASK II: RECOMMENDATIONS FOR SIMPLIFIED INDIVIDUAL ZERO-GRAVITY CLOUD PHYSICS EXPERIMENTS.**  
Calspan Corp., Buffalo, N. Y.  
For primary bibliographic entry see Field 2B.  
W77-00357

**COLIFORM BACTERIA FROM DIFFUSE SOURCES AS A FACTOR IN ESTUARINE POLLUTION.**  
Smithsonian Institution, Edgewater, Md. Chesapeake Bay Center for Environmental Studies.  
For primary bibliographic entry see Field 5B.  
W77-00359

**VERTICAL DIFFUSION DRIVEN BY INTERNAL WAVES IN A SILL FJORD.**  
Norges Tekniske Høgskole, Trondheim. River and Harbor Lab.  
A. Strigebrandt.  
Journal of Physical Oceanography, Vol. 6, No. 4, p 486-495, July 1976. 5 fig, 1 tab, 8 ref. append.

Descriptors: \*Fjords, \*Tides, \*Mixing, \*Internal waves, Model studies, Hydraulic models, Salinity, Saline water-freshwater interfaces, Froude number, Tidal waters, Seiches, Equations, Flow, Waves(Water), Estuaries, Path of pollutants.  
Identifiers: \*Norway, \*Oslofjord(Norway), Sill fjord, Richardson number.

A new mechanism, the breaking of internal waves, was proposed to explain vertical mixing within the lower layers of sill fjords. The generation of the waves at the sill of a fjord was modelled, assuming constant depth except at the narrow sill whose height was the thickness of the lower layer. A barotropic tide oscillating across the sill created internal waves which propagated both seaward and landward from the sill. These waves broke against the bottom, creating boundary turbulence which mixed water of different density in the lower layer. This was demonstrated experimentally. The mix-

ture flowed away from the boundaries into the interior of the fjord, causing an effective vertical mixing. The energy input into the internal waves and the damping of barotropic seiches were computed using linear theory. Possible instability, except at the bottom, was discounted by considering representative Richardson and Froude numbers. The theory was then qualitatively applied to the Oslofjord with particular attention given to the effects caused by changing the sill geometry. An estimate of the Richardson flux number from the Oslofjord data gave a value of 0.05. (Sims-ISWS)  
W77-00360

**CLIMATOLOGICAL NUMERICAL MODELS OF THE SURFACE MIXED LAYER OF THE OCEAN.**  
Woods Hole Oceanographic Institution, Mass.  
R. O. R. Y. Thompson.  
Journal of Physical Oceanography Vol. 6, No. 4, p 496-503, July 1976. 7 fig, 16 ref. ONR N00014-74-C-0262-NR-083-004.

Descriptors: \*Model studies, \*Oceans, \*Water temperature, \*Pacific Ocean, Mathematical models, Forecasting, Temperature, Mixing, Thermocline, Climatology, Oceanography.  
Identifiers: \*Surface mixed layer, \*Ocean Weather Station N(Pacific Ocean).

Three slab models of the surface mixed layer of the ocean were given simple and fast computer implementations. Actual meteorological data from Ocean Weather Station N were used for a year-long forecast. The results compared quite well with the observations of vertical temperature profiles, with correlations up to 0.98 between predicted and observed sea-surface temperatures and of 0.8 between predicted and observed mixed-layer depths. Temperature anomalies introduced in the spring can be covered up in the summer, yet reappear in the winter. A constant-thickness slab was suitable as a lower boundary for some atmospheric climatological studies if a depth of 25 m was used. The model based on a Froude number criterion worked best for the available data set; this was physically appealing since the model contained no adjustable parameters. (Sims-ISWS)  
W77-00361

**THE ROLE OF SURFACE MIXING IN THE SEASONAL VARIATION OF THE OCEAN THERMAL STRUCTURE.**  
Naval Postgraduate School, Monterey, Calif. Dept. of Meteorology.  
R. L. Haney, and R. W. Davies.  
Journal of Physical Oceanography, Vol. 6, No. 4, p 504-510, July 1976. 7 fig, 1 tab, 16 ref. ONR N00014-76-WR-60020.

Descriptors: \*Model studies, \*Oceans, \*Water temperature, \*Pacific Ocean, Mathematical models, Temperature, \*Mixing, Seasonal, Equations, Heat transfer, Climatology, Oceanography, Meteorology.  
Identifiers: \*Ocean Weather Station N(Pacific Ocean).

The role of surface-generated mixing in determining the seasonal variation of the ocean thermal structure was investigated using a one-dimensional numerical model. The model contained vertical eddy diffusion with a constant coefficient  $K_{sub} H = 0.5 \text{ sq cm/s}$ , an instantaneous convective adjustment mechanism as commonly used in oceanic general circulation models, and a simple parameterization of surface-generated wind and convective mixing based on recent mixed-layer theories. Forcing on the seasonal time scale was accomplished by prescribing the atmospheric solar radiation, long-wave radiation, wind speed, temperature, and dew point to vary sinusoidally with the annual period. Results of model integrations showed that surface-generated wind and convective mixing were responsible for producing many features which were observed in the real ocean, in-

## Field 2—WATER CYCLE

### Group 21—Estuaries

cluding the occurrence of two sea surface temperature maxima—one in summer and another in early fall. (Sims-ISWS)  
W77-00362

**SALT FINGERS OBSERVED IN THE MEDITERRANEAN OUTFLOW REGION (34 N, 11 W) USING A TOWED SENSOR.**  
Massachusetts Inst., of Tech., Cambridge. Dept. of Meteorology.  
B. Magnell.  
Journal of Physical Oceanography, Vol. 6, No. 4, p 511-523, July 1976. 12 fig, 16 ref. NSF GA-30729X

Descriptors: \*Atlantic Ocean, \*On-site investigations, \*Temperature, \*Salinity, Instrumentation, Oceans, Conductivity, Data collections, Data transmission, Telemetry, Thermocline, Water temperature, Saline water, Oceanography.  
Identifiers: \*Salt finger convection, \*Mediterranean Outflow region, \*Salt fingers, Towed sensors.

A towed microstructure instrument has been used to measure small-scale conductivity fluctuations in a quasi-horizontal plane, as well as local vertical gradients of temperature and conductivity. This instrument was towed in the Mediterranean Outflow region (34 deg N, 11 deg W) in July 1973, in an area where 'step-like' vertical profiles of temperature and salinity had previously been observed. It was found that intense small-scale horizontal structure (1 cycle/cm) occurred in the thermocline on the thin high-gradient sheets which separated the mixed layers of the step-like structure. Good general agreement between the observed dominant wavelength and amplitude of this structure, and expected theoretical salt finger wavelength and amplitude, strongly suggested that this activity was salt finger convection. (Sims-ISWS)  
W77-00363

**AN INVESTIGATION OF A COLD EDDY ON THE EASTERN SIDE OF THE GULF STREAM USING NOAA 2 AND NOAA 3 SATELLITE DATA AND SHIP DATA.**  
Research Triangle Inst., Research Triangle Park, N. C.  
F. M. Vukovich.  
Journal of Physical Oceanography, Vol. 6, No. 4, p 605-612, July 1976. 12 fig, 1 tab, 4 ref. NOAA/NESS 3-35402.

Descriptors: \*Eddies, \*Atlantic Ocean, \*Remote sensing, \*On-site investigations, \*Satellites(Artificial), Ships, Currents(Water), Ocean currents, Circulation, Ocean circulation, Water circulation, Data processing, Temperature, Water temperature, Entrainment, Salinity, Oceanography.  
Identifiers: \*Gulf Stream.

A study of a cold eddy on the eastern side of the Gulf Stream was performed combining data from the NOAA 2 and NOAA 3 satellites and from the Cape Fear Technical Institute's R/V Advance II. The satellite data were used initially to identify and locate the eddy in real-time. The location data obtained from the satellite imagery were used to plan an oceanic field program using the Advance II to collect temperature and salinity data in the perturbation. The analysis of satellite data indicated that the cold eddy was elliptical in shape with the major axis varying from 180 to 120 km and a minor axis varying from 120 to 100 km. The analysis also suggested that the circulation of the eddy was entraining warm Gulf Stream water, strengthening the warm ring around the eddy. The subsurface analysis indicated that the cold eddy was characterized by a very pronounced dome of relatively cold, less saline water below 200 m. Above 200 m, the temperature and salinity were uniform, both vertically and horizontally. (Sims-ISWS)  
W77-00364

**SIMILITUDE IN COASTAL ENGINEERING.**  
Tetra Tech. Inc., Pasadena, Calif.  
For primary bibliographic entry see Field 8B.  
W77-00380

**MEASUREMENTS OF ESTUARY DISPERSION COEFFICIENTS.**  
Rhodesia Univ., Salisbury. Dept. of Civil Engineering.  
For primary bibliographic entry see Field 5B.  
W77-00381

**GEOGRAPHICAL AND SEASONAL VARIABILITY OF MARINE PLANKTON.**  
Akademiya Nauk SSSR, Leningrad. Zoologicheskii Institut.  
For primary bibliographic entry see Field 5C.  
W77-00393

**ZOOPLANKTON OF DIKSON BAY (KARA SEA).**  
Akademiya Nauk SSSR, Leningrad. Zoologicheskii Institut.  
For primary bibliographic entry see Field 5C.  
W77-00395

**SPECIES COMPOSITION AND DISTRIBUTION OF ECOLOGICAL COMPLEXES OF ZOOPLANKTON IN THE ENISEI GULF.**  
Akademiya Nauk SSSR, Leningrad. Zoologicheskii Institut.  
For primary bibliographic entry see Field 5C.  
W77-00399

**GEOGRAPHICAL VARIABILITY OF SOME SPECIES OF THE FAMILY OITHONIDAE (COPEPODA, CYCLOPOIDA).**  
Akademiya Nauk SSSR, Leningrad. Zoologicheskii Institut.  
For primary bibliographic entry see Field 5C.  
W77-00400

**PROXIMATE NUTRITIVE VALUE CHANGES DURING DECOMPOSITION OF SALT MARSH PLANTS.**  
Mississippi State Univ., Mississippi State.  
For primary bibliographic entry see Field 5C.  
W77-00402

**FISHERY AND BIOLOGY OF METAPENAEUS MONOCEROS (FABRICIUS) FROM THE GODAVARI ESTUARINE SYSTEM.**  
Central Inland Fisheries Research Inst., Barrackpore (India).  
M. Subrahmanyam.  
Indian J Fish. 20(1), p 95-107, 1973.

Descriptors: \*Crustaceans, \*Estuaries, \*Asia, Mangrove swamps, Swamps, Fish diets, \*Fish genetics, \*Shrimp, Shellfish, \*Commercial shellfish, Fish reproduction, Asia.  
Identifiers: Foraminifera, \*India, \*Metapenaeus-Monoceros, \*Prawns, Guatami estuary.

M. monoceros (Fabricius) is one of the important commercial prawns and comprises about 42% in the total prawn landing in the Gautami estuary (India). It is abundant in the lower reaches of the estuaries, particularly in the mangrove swamps and backwaters. The main fishing season extends from Oct.-Jan./Feb. and the dominant sizes in the commercial catches range between 26 mm-65 mm. Drag nets and stake nets are the main gear employed in the fishery. Under laboratory conditions the average growth rate was about 13 mm/mo., while the estimated growth from size frequency distributions ranged between 5 mm and 15 mm/mo. The size of the prawns leaving the estuary was 45-50 mm. Laboratory experiments showed that the prawns were active at night and burrowed into the substratum during the day. The post-larvae en-

tered the estuary in large numbers at night almost throughout the year. The overall sex ratio of the prawns was more or less unity. Plant matter, organic detritus, small crustaceans and foraminifera shells formed the main diet of the prawn.—Copyright 1975, Biological Abstracts, Inc.  
W77-00424

**TRACE-METAL LEVELS IN THE WATERS AND SEDIMENTS OF CORIO BAY (AUSTRALIA).**  
Melbourne Univ., Parkville (Australia). School of Chemistry.  
For primary bibliographic entry see Field 5A.  
W77-00446

**YELLOW SUBSTANCE (GELBSTOFF) AND ITS CONTRIBUTION TO THE ATTENUATION OF PHOTOSYNTHETICALLY ACTIVE RADIATION IN SOME INLAND AND COASTAL SOUTH-EASTERN AUSTRALIAN WATERS.**  
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Plant Industry.  
For primary bibliographic entry see Field 5C.  
W77-00448

**STOICHIOMETRIC DISTANCE AND TOTAL CONCENTRATION: A BINARY NUMERICAL DESCRIPTION OF INLAND WATER CEHMITRY.**  
Tasmania Univ., Hobart (Australia). Dept. of Botany.  
For primary bibliographic entry see Field 2K.  
W77-00449

**DISTRIBUTION OF BENTHONIC FORAMINIFERS OFF THE WESTERN COAST OF SOUTH AMERICA, (IN RUSSIAN).**  
Akademiya Nauk SSSR, Moscow. Institut Okeanologii.  
T. A. Khusid.  
Okeanologiya. 14(6), p 1092-1097, 1974.

Descriptors: \*South America, \*Pacific Ocean, \*Bottom sediments, Sediments, \*Benthos, Biomass, Distribution patterns, Spatial distribution.  
Identifiers: Bolivina-subexcavata, Brizalina-costata, Epistominella-pacifica, \*Foraminifers, Reophax-dentaliniformis, Reophax-subdentaliniformis, \*Vertical distribution.

Studies were made of the vertical quantitative distribution of benthonic foraminifera, and their biomass in the bottom sediments on the Pacific continental slope of South America. The area is characterized by high numbers and biomass of foraminifera. In all the vertical zones, the number of species is not high; the following species are dominant by numbers. Brizalina costata, Bolivina subexcavata, Epistominella pacifica, Reophax subdentaliniformis and R. dentaliniformis. The quantitative distribution of foraminifera and their biomass is similar to the distribution of macrobenthos.—Copyright 1975, Biological Abstracts, Inc.  
W77-00496

**ON THE OCEANOGRAPHIC CONDITIONS OF OYSTER FARMING AREA NEAR CHUNGMU, (IN KOREAN).**  
Tong-yeong Fisheries Junior Technical Coll. (Republic of Korea).  
D. B. Lim, C. Hwan Cho, and W. Sup Kwon.  
Bull Korean Fish Soc. 8(2), p 61-67, 1975.

Descriptors: \*Oysters, \*Shellfish farming, \*Environmental effects, Bays, Oceans, Fish control agents, Fish behavior, \*Aquaculture, Oceanography, Chlorophyll, Mortality, Salinity.  
Identifiers: Chungmu(Korea), \*Korea.

## WATER SUPPLY AUGMENTATION AND CONSERVATION—Field 3

### Use Of Water Of Impaired Quality—Group 3C

Oceanographic conditions in the coastal water around Chungmu, one of the most important oyster farming areas in Korea, were studied from May-Nov. 1974 to determine the environmental influences on oyster farming. Six localities, Goseong Bay, Jaran Bay, off Saryangdo, Hansilpo, Tongyeong Bay and Juklimpo were selected for monthly oceanographic observation and biological sampling. Flood current running westward brings a saline water from the SE and ebb current brings the low salinity water of Jinju Bay into the area. The waters in Juklimpo, Hansilpo and Tongyeong Bay are slightly cooler and more saline than the waters in Goseong Bay, Jaran Bay and off Saryangdo. The amount of dissolved O<sub>2</sub> is lowest in Sept. and Hansilpo has the least O<sub>2</sub> during summer. Silicate content is lower in waters of Tongyeong Bay, Juklimpo and off Saryangdo than those of Goseong Bay, Hansilpo and Jaran Bay. Suspended matter in this area ranges from 7.2-16.6 mg/l; it is scarce in Jaran Bay, Juklimpo and off Saryangdo. Chlorophyll *a* shows large seasonal variation and local fluctuation. Composition of phytoplankton reveals the difference between the waters of Goseong Bay, Jaran Bay and off Saryangdo and the waters of Hansilpo, Tongyeong Bay and Juklimpo. The growth of oysters was good in Juklimpo, Tongyeong Bay and Goseong Bay and worst in Hansilpo. The highest mortality (82%) was observed in the waters off Saryangdo.—Copyright 1976, Biological Abstracts, Inc. W77-00498

**DIET OF HIPPOGLOSSINA MACROPS (STEINDACHNER) IN MEJILLONES (PISCES, BOTHIDAE), (IN SPANISH),** Universidad de Norte, Antofagasta (Chile). J. Tomicic-K. Mus Nac Hist Nat Not Mens (Santiago). 17(205), p 3-7, 1973.

Descriptors: \*Fish diets, Fish, Fish food organisms, Bays, South American, Crustaceans. Identifiers: Pisces, Bothidae, \*Chile, \*Hippoglossina-Macrops, \*Mejillones Bay(Chile), Pleuronocodes-Monodon.

Specimens (287) of *H. macrops*, captured at Mejillones Bay (Chile) from Aug.-Nov. 1971, were measured (total length) and the stomach contents were analyzed. The preferred food is crustaceans. The length frequency distribution shows 3 clear modal groups. The feeding of the 3 groups was compared; groups I and III have almost completely different diets. Both groups probably occupy different ecological niches. Group II is the transition between group I and group III. Only 1 animal, *Pleuronocodes monodon*, was found in the diet of all 3 modal groups.—Copyright 1975, Biological Abstracts, Inc. W77-00502

**POTAMOGETON PERFORIATUS IN A BRACKISH-WATER ESTUARY AT ORA, FREDRIKSTAD (S. NORWAY), (IN NORWEGIAN),** Norsk Institutt for Vannforskning, Blindern. For primary bibliographic entry see Field 5C. W77-00508

**BENTHIC BIONOMY OF THE CONTINENTAL SHELF OF THE FRENCH CATALANIAN COAST: 8. MACROFAUNA AND MEIOFAUNA, QUANTITATIVE AND BIOECOTIC RELATIONS, (IN FRENCH),** Museum National d'Histoire Naturelle, Paris (France). Laboratoire de Biologie des Invertébrés Marins. A. Guille, and J. Soyer. Vie Milieu Ser B Oceanogr. 24(2), p 301-320, 1974.

Descriptors: Wildlife, \*Copepods, Aquatic life, Plankton, Seston, Zooplankton, Crustaceans, \*Europe, \*Aquatic populations, Population,

\*Analysis, \*Continental Shelf, \*Benthic fauna, Ecology. Identifiers: Bionomy, Catalanian coast, Fauna, Taxocenosis, \*France.

In qualitative terms, the distribution of the populations of harpacticoid copepods on the continental shelf of the French catalan coast corresponds largely to the distribution of the communities of the macrofauna. Complementary units or bionomical subdivisions may be distinguished according to the higher sensibility of the meiofauna to the physicochemical conditions, mainly thermal and granulometric. The structure of the populations of the 2 stocks shows that the high specific diversity of the harpacticoids varies only to a certain extent with different populations; the different populations; the different groups forming the macrofauna generally show a preference for 1 type of biotope. These comparisons between taxocenoses, and between taxocenoses and biocenoses, seem to improve the bionomical definition of a region in spite of the different dimensional levels of the ecological niches of the taxa considered. The density of macrobenthos is feeble as compared to the densities in the boreal zone; the quantity of meiobenthic organisms is very similar. The latter category shows, a higher relative importance which is apparently related to its capacity to occupy small ecological niches and to proliferate in areas not favoring the development of macrofauna. The numerical quantitative evolution of the 2 stocks is parallel, being related to the bathymetry. The biomass of the macrobenthos may be relatively independent of the density because of the diversity in the size of its components, in contrast to the meiobenthos. The weight ratio shows that the meiobenthos comprises 4.75% of the biomass of the macrobenthos. On the continental shelf of the French catalan coast, the importance of the meiobenthos in terms of ingested food and biomass entering the food chain is about 24%.—Copyright 1976, Biological Abstracts, Inc. W77-00516

### 3. WATER SUPPLY AUGMENTATION AND CONSERVATION

#### 3A. Saline Water Conversion

**WASTEWATER TREATMENT BY REVERSE OSMOSIS,** Hitachi Ltd., Tokyo (Japan). Environmental Protection Systems Div. For primary bibliographic entry see Field 5D. W77-00081

#### 3B. Water Yield Improvement

**FINAL REPORT ON AN INVESTIGATION OF PRECIPITATING ICE CRYSTALS FROM NATURAL AND SEEDED WINTER OROGRAPHIC CLOUDS,** Western Scientific Services, Inc., Fort Collins, Colo. L. Vardiman, and C. L. Hartzell. Report SR-359-4, June 1976. 129 p, 98 fig, 8 tab, 11 ref, 5 append. Bureau of Reclamation 14-06-D-6644.

Descriptors: \*Weather modification, Cloud physics, \*Ice crystals, \*Colorado, Rocky mountain region, \*Orographic clouds, \*Cloud seeding, \*Iodine. Identifiers: San Juan Mountains(Colo).

Findings are presented of an investigation into the changes expected in ice crystal characteristics caused by silver iodide seeding of winter, orographic clouds in the San Juan Mountains of Colorado. Ice crystal data were collected from 22 storms near Wolf Creek Pass for the period of

February 1973 through March 1975. Additional data on ice nuclei and cloud-top temperatures were also obtained. Analyses were performed on the crystal type, size, concentration, and the amount of rime under seeded and natural conditions. The storms were subdivided into three-hour blocks based on sounding times. Each block was classified into a seed or nonseed category depending on generator operations and ice nucleus concentrations. A total of 66 three-hour blocks was studied. Changes in ice crystal characteristics were observed near Wolf Creek Pass when artificial nuclei were detected in and slightly upwind of the target area. Precipitation and ice crystal concentrations were increased and rime was decreased as expected. Relative concentrations of plates and columns were increased. Crystal diameter was increased against expectation. Ice crystal concentration measured at KP3 does not appear to be a function of cloud-top temperature for either seeded or nonseeded cases. However, seeding does increase the crystal concentration at all temperatures. (Bur Reclam) W77-00096

**MEASUREMENTS OF LIQUID WATER CONTENT IN WINTER CLOUD SYSTEMS OVER THE SIERRA NEVADA,** Nevada Univ., Reno. Desert Research Inst. For primary bibliographic entry see Field 2B. W77-00164

**EROSION AND RUNOFF ON FOREST AND RANGE LANDS,** Forest Service (USDA), Ogden, Utah. Intermountain Forest and Range Experiment Station. For primary bibliographic entry see Field 4C. W77-00332

**ESTIMATION AND SIMULATION OF SHEET RUNOFF,** Commonwealth Scientific and Industrial Organization, Canberra (Australia). Div. of Land Use Research. For primary bibliographic entry see Field 4A. W77-00439

**WATER RELATIONS OF GLYCYPHRIZA GLABRA L. UNDER DESERT CONDITIONS,** Cairo Univ., Giza (Egypt). Dept. of Botany; and Cairo Univ., Giza (Egypt). Faculty of Science. For primary bibliographic entry see Field 2I. W77-00500

### 3C. Use Of Water Of Impaired Quality

**BEFORE REMOVING NUTRIENTS...REANALYZE LAKE TAHOE,** Utah Water Research Lab., Logan. For primary bibliographic entry see Field 5C. W77-00045

**WATER-REUSE SYSTEMS STAR AT CINCINNATI AICHE MEETING,** For primary bibliographic entry see Field 5D. W77-00054

**SODIUM CARBONATE IN GROUND WATERS OF THE TURKMEN SSR, (IN RUSSIAN),** I. N. Stepanov, V. S. Muratova, and Z. F. Povetukhina. Probl Osvoeniya Pustyn' 2, p 79-81, 1975.

Descriptors: \*Groundwater, \*Carbonates, Irrigation, Water pollution. Identifiers: \*Turkmen-SSR, USSR, \*Sodium carbonate.



## Field 3—WATER SUPPLY AUGMENTATION AND CONSERVATION

### Group 3C—Use Of Water Of Impaired Quality

Ground waters containing sodium carbonate are found throughout the whole territory of Turkmenistan (USSR). Sodium carbonate in the process of irrigation deteriorates the meliorative conditions of the territory.—Copyright 1976, Biological Abstracts, 122.  
W77-00384

**EFFLUENT-FREE BLEACHED KRAFT PULP MILL. PART VII. SODIUM CHLORIDE IN ALKALINE PULPING AND CHEMICAL RECOVERY.**  
Erco Envirotech Ltd., Islington (Ontario).  
For primary bibliographic entry see Field 3E.  
W77-00466

### 3D. Conservation In Domestic and Municipal Use

**APPLICATION OF A HYDROLOGIC MODEL TO THE PLANNING AND DESIGN OF STORM DRAINAGE SYSTEMS FOR URBAN AREAS.**  
Utah Water Research Lab., Logan.  
For primary bibliographic entry see Field 4A.  
W77-00004

**SLUDGE MANAGEMENT ALTERNATIVES FOR COASTAL CITIES.**  
Engineering-Science, Inc., Berkeley, Calif.  
For primary bibliographic entry see Field 5E.  
W77-00014

**BY-PRODUCT SOLIDS MANAGEMENT ALTERNATIVES CONSIDERED FOR PHILADELPHIA.**  
Greeley and Hansen, Chicago, Ill.  
For primary bibliographic entry see Field 5E.  
W77-00015

**SLUDGE DISPOSAL ALTERNATIVES FOR BOSTON.**  
Havens and Emerson Ltd., Cleveland, Ohio.  
For primary bibliographic entry see Field 5E.  
W77-00016

**ALTERNATIVES FOR DISPOSAL FOR THE METROPOLITAN DENVER SEWAGE DISPOSAL DISTRICT NO. 1.**  
Metropolitan Denver Sewage Disposal District Number 1, Commerce City, Colo.  
For primary bibliographic entry see Field 5E.  
W77-00017

**ENERGY CONSERVATION PRACTICES IN MUNICIPAL SLUDGE MANAGEMENT.**  
Public Technology, Inc., Washington, D. C.  
For primary bibliographic entry see Field 5D.  
W77-00018

**SAN DIEGO: CIVIL ENGINEERING INNOVATIONS ABOUND.**  
For primary bibliographic entry see Field 5D.  
W77-00063

**ECOLOGICALLY BALANCED COMMUNITY WASTEWATER DISPOSAL SYSTEMS MANAGEMENT FOR DEVELOPING COUNTRIES.**  
Jadavpur Univ., Calcutta (India).  
For primary bibliographic entry see Field 5D.  
W77-00066

**URBAN STORMWATER DETENTION AND FLOW ATTENUATION.**  
For primary bibliographic entry see Field 5D.  
W77-00078

**URBAN WATERSHED MANAGEMENT USING ACTIVITY INDICATORS TO PREDICT WATER QUALITY.**  
Carnegie-Mellon Univ., Pittsburgh, Pa. Environmental Studies Inst.  
For primary bibliographic entry see Field 5A.  
W77-00106

**COPING WITH INCREASING COSTS.**  
Black and Veatch, Kansas City, Mo.  
R. F. Banker.  
Journal American Water Works Association, Vol. 67, No. 11, p. 600-603, 1976.

Descriptors: \*Water costs, \*Inflation(Economic), \*Water works, Peak loads, Financing, Water loss, Water rates, Economic efficiency, Capital costs, Operating costs, Maintenance costs.

The impact on water utilities of inflationary increases in unit costs of service and how to cope with them are discussed. Costs for electrical energy, supplies, and salaries plus fringe benefits usually cannot be controlled by the utility, but the utility can practice sound management, control purchase amounts, and use supplies efficiently. An objective study of utility operations might indicate areas for increased efficiency. Sometimes capital expenditures to improve service and system reliability can reduce operating expenses. Although operating expense increases affect the utility immediately, ultimately costs related to new capital investment affect the total budget. Sound facility design is essential. Alternatives for financing construction might reduce costs. System losses should be determined and eliminated. Peak demands should be smoothed; by improving the system-load factor, excess capacity in existing systems might meet growth requirements without increasing investment. When rate increases are necessary, public officials and citizens must be assured that the system is well-run and that each is paying only a fair share of costs. Costs should be proportionally distributed when multiple services are provided by the water utility. New customers should finance system growth to prevent increased rates for all customers. (Buchanan-Davidson-Wisconsin).  
W77-00172

**DIGITAL-MODEL ANALYSIS TO PREDICT WATER LEVELS IN A WELL FIELD NEAR COLUMBUS, INDIANA.**  
Geological Survey, Indianapolis, Ind.  
For primary bibliographic entry see Field 4B.  
W77-00482

### 3E. Conservation In Industry

**AN OVERVIEW: SO YOU WANT TO RECYCLE YOUR WASTEWATER. HOW SHOULD YOU BEGIN. IS IT FEASIBLE.**  
For primary bibliographic entry see Field 5D.  
W77-00079

**ENVIRONMENT, ENERGY, AND CAPITAL IN THE FOSSIL FUELED ELECTRIC POWER INDUSTRY.**  
Houston Univ., Tex.  
R. G. Thompson, L. T. Moore, J. A. Calloway, H. P. Young, and R. J. Liviano.  
Computers and Operations Research, Vol. 3, No. 2/3, p. 241-257, August 1976. 9 fig, 12 tab, 14 ref.

Descriptors: \*Environment, \*Linear programming, \*Economics, \*Electric power industry, \*Fossil fuels, \*Energy, Evaluation, Management, Capital costs, Operating costs, Marginal costs, Optimization, Waste water treatment, Water quality control, Effluents, Air quality, Water, Utilization, Wastes, Mathematical models, Systems analysis.  
Identifiers: Cost minimization.

Shown is how cost-conscious managers in the fossil-fueled electric power industry would respond to legislated environmental policy, increasing electricity requirements, higher resource prices, and decreased capital availability. A linear programming economic model has been used to evaluate how managers would substitute production processes, factor inputs (fuel, water, capital), and waste discharges for each specification of environmental policy and availabilities of energy and capital. The model synthesizes the important technical information into a comprehensive economic basis for analysis. All prices and costs are in constant 1973 dollars. According to results, imposition of the most stringent environmental constraint increased production costs by 50%. Stringent air pollution criteria causes shifts both away from use of high-sulfur coal and toward generation by new technologies. As electricity requirements increased, effluent standards became more restrictive, clean fuel became scarcer, shifts toward generation by the new technologies again occurred and marginal and average costs of production increased. Demand by utilities for low-sulfur coal was especially sensitive to the price of coal. Capital requirements for utilities through 1985 generally fell within forecast limits of availability from the economy except for the lowest forecast of capital availability. (Bell-Cornell)  
W77-00118

**MARINE SAND AND GRAVEL MINING.**  
Geological Survey, Menlo Park, Calif. Conservation Div.  
M. J. Cruckshank, and H. D. Hess.  
Oceanus, Vol. 19, No. 1, p. 32-44, 1975. 11 fig., 2 tab., 14 ref.

Descriptors: \*Continental margin, \*Sands, \*Gravels, \*Mining, Environmental effects, Dredging, Costs, Monitoring.  
Identifiers: \*Marine mining.

Based on current projections the world's terrestrial supply of sand and gravel will be depleted by the year 2000. To meet anticipated needs, sand and gravel deposits on the coastal margins are being considered. Marine aggregate mining has been very limited in the United States since public protests have resulted in dredging moratoria in most coastal areas. Costs would be competitive with those on land. It has been estimated that about 1400 billion tons are present in all U.S. coastal regions in a ratio of about 15 to 1, sand to gravel. Underwater mining is usually by a dredge that digs a pit or one that skims off the top layer of material. Environmentally this may alter the sea floor shape, interfere with other uses, and disturb marine ecosystems. Both beneficial and adverse effects are possible. Resource conservation and environmental management research is needed. Continual monitoring will be required. Adverse environmental effects are probably more damaging to physical features of coastal areas and the resource base than the ecology. With adequate information on the deposits and environment, sound resource management practices could prevent or minimize damage of mining operations. (Buchanan-Davidson-Wisconsin).  
W77-00195

**STATUS REPORT ON ABATEMENT OF EFFLUENTS FROM THE CANADIAN PULP AND PAPER INDUSTRY -- 1974.**  
Environmental Protection Service, Ottawa (Ontario).  
For primary bibliographic entry see Field 5G.  
W77-00331

**COLOR REMOVAL FROM SOFTWOOD KRAFT CAUSTIC EXTRACT EFFLUENT BY POLYAMINES.**  
Institute of Paper Chemistry, Appleton, Wis.  
For primary bibliographic entry see Field 5D.  
W77-00335

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**SORPTION ON ACTIVATED CARBON OF IMPURITIES OF TEXTILE INDUSTRY EFFLUENTS (SORPCJA ZANIECZYSZCZEN ZE SCIEKOW PRZEMYSŁU WŁOKIENNICZEGO NA WĘGLU AKTYWNYM),**  
Centralne Laboratorium Dzierziarstwa (Poland).  
For primary bibliographic entry see Field 5D.  
W77-00339

**PAPER CHEMICAL RECLAMATION AND REUSE VIA REVERSE OSMOSIS,**  
For primary bibliographic entry see Field 5D.  
W77-00340

**EFFECTIVENESS OF WASTEWATER TREATMENT AT THE SHOSTKA 50TH ANNIVERSARY OF THE USSR CHEMICAL PLANT, (IN RUSSIAN),**  
For primary bibliographic entry see Field 5D.  
W77-00351

**ENVIRONMENTAL FACTORS IN PRODUCING SUPPLEMENTAL FUELS,**  
For primary bibliographic entry see Field 6G.  
W77-00390

**THE VIEW OF THE PAPER INDUSTRY ON THE OCCURRENCE OF PCB'S IN THE ENVIRONMENT AND THE NEED FOR REGULATION,**  
Container Corp. of America, Carol Stream, Ill.  
For primary bibliographic entry see Field 5B.  
W77-00461

**STATEMENT RELATING TO POLYCHLORINATED BIPHENYLS ON BEHALF OF THE WISCONSIN PAPER COUNCIL,**  
Bergstrom Paper Co., Neenah, Wis.  
For primary bibliographic entry see Field 5B.  
W77-00462

**CENTRIFUGE PLUS LIME LIMITS LIGNIN IN WASTE WATER,**  
For primary bibliographic entry see Field 5D.  
W77-00464

**SPENT SEMICHEMICAL PULPING LIQUORS. (V). IMPROVEMENT OF COLOR-REMOVAL EFFICIENCY BY PHOTOCHEMICAL TREATMENT (IN JAPANESE),**  
Kyushu Univ., Fukuoka (Japan).  
For primary bibliographic entry see Field 5D.  
W77-00465

**EFFLUENT-FREE BLEACHED KRAFT PULP MILL. PART VII. SODIUM CHLORIDE IN ALKALINE PULPING AND CHEMICAL RECOVERY,**  
Erco Envirotech Ltd., Islington (Ontario).  
D. W. Reeve.  
Pulp and Paper Canada, Vol. 77, No. 8, p 35-37, 39, 41-42, 44-45 (T136-142), August, 1976. 7 fig, 4 tab, 78 ref.

Descriptors: \*Pollution abatement, \*Pulp wastes, \*Sodium chloride, \*Bleaching wastes, \*Water conservation, Water pollution sources, Wastes, Industrial wastes, Water pollution control, Evaporation, Effluents, Publications, Reviews, Water reuse, Recirculated water.  
Identifiers: \*Chemical recovery, \*Kraft mills, Washing(Pulp), Black liquor, White liquor.

A review of the literature on NaCl in alkaline pulping and chemical recovery is presented. The input of NaCl with wood, chemicals, and water supply, the history of NaCl accumulation in recovery systems, and methods available for NaCl control and removal are reviewed. In the effluent recovery program, all effluents from a

D/CEDED bleach plant are used to wash the brown stock and to prepare fresh cooking liquor. Sodium chloride, as a spent bleaching chemical, thereby enters the pulping chemical recovery cycle. White liquor is evaporated to recover the NaCl in pure crystalline form and to control NaCl load in the recovery cycle by the salt recovery process (SRP). Alkaline pulping and chemical recovery operations are not significantly affected by the moderate NaCl concentrations and loads which result from the proposed system. There is no apparent effect of NaCl on cooking, brown stock washing, black liquor evaporation, or white liquor preparation. Some of the properties of black liquor, smelt, and furnace dust are changed, but no significant effect results. (See also W74-07379 and W74-05275) (Sykes-IPC)  
W77-00466

### 3F. Conservation In Agriculture

**CHARACTERISTICS OF RURAL HOUSEHOLD WASTEWATER,**  
Wisconsin Univ., Madison. Small Scale Waste Management Project.  
For primary bibliographic entry see Field 5A.  
W76-00048

**WEATHER-DEPENDENT PRICING FOR WATER RESOURCES IN THE TEXAS HIGH PLAINS,**  
International Bank for Reconstruction and Development, Washington, D. C.  
M. N. Lane, and S. C. Littlechild.  
Water Resources Research, Vol. 12, No. 4, p 599-605, August 1976. 4 tab, 9 ref.

Descriptors: \*Irrigation water, \*Pricing, \*Linear programming, Optimization, Weather, Reservoirs, Water supply, Farms, Profit, Crops, Constraints, Costs, Rainfall, Equations, Mathematical models, Systems analysis.  
Identifiers: Uncertainty, High Plains of Texas.

Two alternative schemes for pricing irrigation water are examined. Under the first scheme, price is independent of weather; in the second scheme, price varies with weather so as to generate just enough demand to exhaust reservoir capacity. The second scheme provides savings through the more efficient utilization of available reservoir supplies and through the curtailing of demand so as to allow the construction of smaller reservoirs. The analysis proceeds by means of a linear programming under uncertainty model of a representative farm. The model is applied to the High Plains of Texas. Results suggest that the weather-dependent pricing scheme would increase farm profits by the order of 10% per annum.  
W77-00122

**SURFACE RUNOFF LOSSES OF FERTILIZER ELEMENTS,**  
Louisiana State Univ., Baton Rouge. Dept. of Agronomy; and Louisiana Agricultural Experiment Station, Baton Rouge.  
For primary bibliographic entry see Field 5B.  
W77-00165

**NITROGEN IN SUBSURFACE DISCHARGE FROM AGRICULTURAL WATERSHEDS,**  
Agricultural Research Service, Columbia, Mo.  
For primary bibliographic entry see Field 5B.  
W77-00166

**A REGIONAL MARKET FOR RIGHTS TO USER FERTILIZER AS A MEANS OF ACHIEVING WATER QUALITY STANDARDS,**  
Illinois Univ. at Urbana-Champaign. Dept. of Agricultural Economics.  
For primary bibliographic entry see Field 5G.  
W77-00173

**USING LINEAR PROGRAMMING TO EVALUATE AGRICULTURAL FLOOD CONTROL PROJECTS,**  
Economic Research Service, Berkeley, Calif. Natural Resource Economics Div.  
D. G. Piper.  
Journal of Soil and Water Conservation, Vol. 30, No. 5, p. 227-230, 1975. 1 fig., 3 tab., 8 ref.

Descriptors: \*Cost-benefit analysis, \*Agriculture, \*Project benefits, \*Flood control, \*Evaluation, Linear programming, Model studies, River basin development, Water resources development, Crop production, Flood protection, \*Indiana.  
Identifiers: Wabash River Basin(Ind).

A regional least-cost linear programming model for river basin planning was developed to identify the economic potential for water resource development as related to agricultural production. It is based on the assumptions that the region is internally homogeneous in each soil management group; constant returns per acre are obtained for each soil management group; available cropland acreage limits production and all crops compete for it; farmers minimize crop production costs; demands for food and fiber are exogenously determined and known; and available resources, input-output coefficients, and prices are known. If appropriately modified, this model can be used as an analytical framework and data base to evaluate agricultural benefits of proposed flood-control projects. Such a project evaluation model can estimate the cost of producing specified outputs from an area under conditions of present flood hazards and with flood protection. Differences between these two estimates provide a single measure of benefits reflecting direct damage reduction and net regional enhancement effects. The model also can provide estimates of probable land use changes associated with a change in the level of flood protection. (Buchanan-Davidson--Wisconsin)  
W77-00180

**STATE OF SOUTH CAROLINA WEATHER AND CROP SUMMARIES,**  
South Carolina Water Resources Commission, Columbia.  
G. E. Richardson, J. C. Purvis, and R. Foster.  
June 1976, 66 p, 25 fig, 4 tab.

Descriptors: Crop production, Precipitation(Atmospheric), Climates, \*Rainfall, \*South Carolina, Water supply, Climatic data, Weather data, Flood data, \*Data collections.

A compilation of weather and crop data summaries for each month of 1975 in South Carolina is given. This is the third of a series designed to consider the relationships of crop productivity and precipitation, and the possibility that productivity is a predictable function of climatic conditions, particularly rainfall.(NOAA)  
W77-00282

**SPATIAL VARIABILITY IN SOILS BELOW DEPTH OF TILLAGE: BULK DENSITY AND FIFTEEN ATMOSPHERE PERCENTAGE,**  
North Carolina State Univ., Raleigh. Dept. of Soil Science.  
For primary bibliographic entry see Field 2G.  
W77-00284

**TWO-DIMENSIONAL SOLUTES TRANSFER DURING NONSTEADY INFILTRATION: LABORATORY TEST OF MATHEMATICAL MODEL,**  
Cornell Univ. Agricultural Experiment Station, Ithaca, N.Y. Dept. of Agronomy.  
For primary bibliographic entry see Field 2G.  
W77-00288

## Field 3—WATER SUPPLY AUGMENTATION AND CONSERVATION

### Group 3F—Conservation In Agriculture

**VARIATIONS IN THE NATURAL ABUNDANCE OF N OF WHEAT PLANTS IN RELATION TO FERTILIZER NITROGEN APPLICATIONS**, Washington Univ., St. Louis, Mo. Center for the Biology of Natural Systems.  
G. Shearer, and J. O. Legg.  
Soil Science Society of America Proceedings, Vol. 39, No. 5, p 896-901, September-October 1975. 4 fig, 3 tab, 11 ref.

Descriptors: \*Nitrogen, \*Fertilization, \*Fertilizers, \*Wheat, Crop response, \*Pennsylvania, Measurement, Laboratory tests.  
Identifiers: \*Soil fertility.

Measurements were made by two laboratories of the per mill (15)N excess of winter wheat plants grown at five locations in Pennsylvania on experimental plots. The plots were fertilized with N at various rates. The results from both laboratories showed a consistent decline in per mill (15)N excess with increasing rates of N application. Such a decrease in per mill (15)N excess is consistent with increasing contributions of fertilizer N to the plants as the rate of application increased, given that fertilizer N has a lower 15N content than the soil N. The coefficients of regression of per mill (15)N excess of wheat on N application rate were always negative and usually significantly different from zero. The regression coefficients computed from the results of the two laboratories were not significantly different from each other in 12 of 16 experiments. There was, however, a systematic, unexplained difference in the results from the two laboratories. A regression of one set of data on the other resulted in a regression coefficient significantly different from one, the theoretically expected value. (Skogerboe-Colo St)  
W77-00292

**ECONOMICS OF INCREASED MOBILITY FROM TILE DRAINAGE**, Mosul Univ. (Iraq). Coll. of Engineering.  
A. S. Y. Aldabagh, and C. E. Beer.  
Transactions of the American Society of Agricultural Engineers, Vol. 18, No. 1, p 116-121, January-February 1975. 4 fig, 3 tab, 16 ref.

Descriptors: \*Drainage, \*Drainage engineering, \*Drains, \*Drainage systems, Economics, Economic impact, \*Tile drains, Cost estimates.

The purpose was to estimate the added economic benefit of tile drainage from increased mobility of agricultural machinery. This was achieved by first relating the performance of vehicles to soil strength in terms of rating cone index. The rating cone index was evaluated by the cone penetrometer and remodeling equipment. Relations then were developed between soil strength, moisture content, and depth to water table for poorly drained soils. Existing data were used in predicting the behavior of water table for various drain spacings and soil conductivities. A tile depth of 4 ft, a tile diameter of 0.5 ft, and a depth to the impervious layer below the drain of 4 ft, were assumed. The results were applied to determine the increased number of days in which machine operations can be performed during the planting season when tile drains with various spacings are used. (Skogerboe-Colo State)  
W77-00313

**A SYSTEMATIC PROCEDURE FOR TAXING AGRICULTURAL POLLUTION SOURCES**, Colorado State Univ., Fort Collins. Dept. of Agricultural Engineering.  
For primary bibliographic entry see Field 5G.  
W77-00314

**ANNOTATED BIBLIOGRAPHY ON TRICKLE IRRIGATION**, Colorado State Univ., Fort Collins. Dept. of Agricultural Engineering.  
S. W. Smith, and W. R. Walker.  
Information Series No. 16, June 1975. 61 p.

Descriptors: \*Irrigation, \*Irrigation effects, \*Irrigation practices, \*Irrigation design, \*Irrigation efficiency, \*Irrigation engineering, \*Irrigation systems, Evapotranspiration, Fertilization, Crop response, \*Bibliographies.  
Identifiers: \*Trickle irrigation, \*Drip irrigation.

Trickle irrigation (or drip irrigation) is a relatively new approach to supplying agricultural crops with moisture where natural precipitation is inadequate. Research relating to trickle irrigation is being conducted throughout the world, including a significant effort in the United States. To date the application of this irrigation method in Colorado has been considered feasible only in orchards or greenhouses. However, increased emphasis on improving irrigation water management capabilities for salinity control, revegetation of lands disturbed by mining activities, etc. necessitates further examination. This report presents a compilation of 182 annotated references from approximately 30 sources of technical literature. Its purpose is to allow the reader to assess the existing knowledge and evaluate information relevant to the problems being encountered as well as indicating where further study is necessary. A key word index is provided as an appendix. (Skogerboe-Colo St)  
W77-00315

**PERFORMANCE AND EVALUATION OF COMBINED MOLE-TILE DRAIN SYSTEM IN HEAVY SOILS**, Utah State Univ., Logan.  
For primary bibliographic entry see Field 4A.  
W77-00316

**AN EXPERIMENTAL BURIED MULTISET IRRIGATION SYSTEM**, Agricultural Research Service, Kimberly Idaho. Snake River Conservation Research Center.  
R. V. Worstell.  
Presented at the 1975 Winter Meeting of the American Society of Agricultural Engineers, December 15-18, 1975, Chicago, Illinois, 15 p, 8 fig, 2 tab, 7 ref.

Descriptors: \*Irrigation, \*Irrigation systems, Irrigation design, Irrigation effects, Irrigation efficiency, Irrigation practices, Water conservation, Soil moisture, Soil moisture movement, Design criteria, Construction, Operations

Criteria for the design, construction, and operation of an experimental buried lateral, gravity multisets irrigation system are presented. The system has a potential water application efficiency of 80% with very little runoff or erosion without automatic controls. With automatic controls and with water available on demand, light, frequent irrigations can be applied with efficiencies of 90 to 95%. The energy required to operate the system is minimal and labor requirements involve only periodic inspection and maintenance services. Cost and benefit estimates indicate that this system may be economically feasible, practical, and attractive at a time of rising energy costs and labor shortages. (Skogerboe-Colo St)  
W77-00317

**ENERGY GRADIENT LINE FOR DRIP IRRIGATION LATERALS**, Hawaii Univ., Honolulu. Dept. of Agricultural Engineering.  
I-p. Wu, and H. M. Gitlin.  
Journal of the Irrigation and Drainage Division, Proceedings of ASCE, Vol. 101, No. IR4, p 323-326, December 1975. 1 fig, 2 ref, append.

Descriptors: \*Irrigation, \*Irrigation design, \*Hydraulics, \*Irrigation systems, Mathematical analysis, Simulation analysis.  
Identifiers: \*Drip irrigation, \*Trickle irrigation.

Derived mathematical equations for energy gradient lines can be applied to hydraulic analysis of both drip and sprinkler irrigation systems. Also, the equations can be used to simplify computer simulations for irrigation system studies and design. (Skogerboe-Colo St)  
W77-00318

**TRANSPORT OF CARBON14-ASSIMILATES IN THE SUGAR BEET UNDER DIFFERENT CONDITIONS OF NUTRITION AND MOISTURE, (IN RUSSIAN)**, Kirgiz State Univ., Frunze (USSR).  
For primary bibliographic entry see Field 5B.  
W77-00421

**EFFECT OF IRRIGATION PUMPING ON DESERT PUFFISH HABITATS IN ASH MEADOWS, NYE COUNTY, NEVADA**, Geological Survey, Carson City, Nev.  
For primary bibliographic entry see Field 8I.  
W77-00427

**THE VARIABILITY OF MONTHLY RAINFALL IN SOUTH AUSTRALIA**, Commonwealth Scientific and Industrial Research Organization, Glen Osmond (Australia). Div. of Mathematical Statistics.  
For primary bibliographic entry see Field 2B.  
W77-00443

**A WATER BALANCE MODEL AND SUPPLY INDEX FOR WHEAT IN SOUTH AUSTRALIA**, Commonwealth Scientific and Industrial Research Organization, Adelaide (Australia). Div. of Soils.  
E. L. Greacen, and C. T. Hignett.  
CSIRO Australia Division of Soils, Technical Paper No. 27, 1976. 33 p., 14 fig., 23 ref., append.

Descriptors: \*Computer models, \*Water balance, \*Wheat, \*Available moisture, \*Crop production, Water storage, Soil moisture, Soil-water-plant relationships, Water requirements, Evapotranspiration, \*Australia.

A water balance model has been developed to simulate the soil water regime under wheat in southern Australia. Two soil layers are considered, broadly corresponding to the surface and subsoil horizons, on which the growing root zone of the crop is imposed. Required inputs for weather are daily rainfall and potential evaporation, and for the soil, the upper and lower limits of available water, field capacity and wilting point, and an initial starting point value for stored water. The performance of the model in predicting available water was best when the rate of uptake of subsoil water was limited by the length of roots in the subsoil. For ten crops covering three years, the discrepancy between predicted and measured total stored water in the soil rarely exceeded one cm. A useful index of the water supply factor related to crop yield is given. The total water evaporated by the crop from seeding to standard week number 48 accounted for 86 per cent of the variability in yield on ten well-documented sites. Details of the FORTRAN IV computer programme are given in an appendix. (CSIRO)  
W77-00444

**ENVIRONMENTAL CONSIDERATIONS IN EXPANDING AGRICULTURAL PRODUCTION**, Latin American Program for Resources for the Future, Inc., Washington, D.C.  
For primary bibliographic entry see Field 6G.  
W77-00470

**EROSION IN 1973-74: THE RECORD AND THE CHALLENGE**, Soil Conservation Service, Washington, D.C.  
For primary bibliographic entry see Field 2J.  
W77-00471



**EPA AND AGRICULTURE: ESTABLISHING A PARTNERSHIP.**  
Environmental Protection Agency, Washington, D.C.  
For primary bibliographic entry see Field 5G.  
W77-00472

**QUALITATIVE COMPOSITION OF THE SUSPENDED SEDIMENTS OF THE ORDZ-HONIKIDZE IRRIGATION SYSTEM, (IN RUSSIAN).**  
For primary bibliographic entry see Field 2J.  
W77-00497

**LIGHT-CHESTNUT LONG-IRRIGATED SOIL OF THE SHARUR PLAIN, (IN RUSSIAN).**  
For primary bibliographic entry see Field 2G.  
W77-00510

**ORIGIN AND USE OF RUDYAK SOILS, FERUGINOUS SOLONCHAKS OF THE TAIGA ZONE, (IN RUSSIAN).**  
Moscow State Univ. (USSR). Dept. of Soil Physics and Reclamation.  
For primary bibliographic entry see Field 2G.  
W77-00511

**INFLUENCE OF AN INSERTED ASPHALT LAYER ON THE PLANT YIELD ON A LIGHT SOIL, (IN POLISH).**  
Instytut Uprawy Nowozenia i Gleboznaqatwa, Laskowice Olawskie (Poland). Zaklad Uprawy Roli.  
I. Gonetowa, J. Sienkiewicz, and H. Zurawski.  
Pamięt Pulawski. 60, p 7-18, 1974.

Descriptors: \*Plant growth, \*Asphalt, Soil pressure, \*Soil compaction, Water requirements, Oats, Peas, Corn(Field).  
Identifiers: Lupine, Mustard.

Two liquid asphalts of various viscosity and a solid asphalt were used in pot and microplot experiments. In pot experiments the direct influence of asphalt insertion on the yields of mustard, oats, maize and field pea were investigated. On microplots maize, oats and lupine were grown in rotation and the direct effect of inserted asphalt as well as the after effect during 2 yr were investigated. The liquid asphalts had a toxic effect on all the plants, but the solid asphalt increased plant yield. The yield increases were higher in microplot experiments where the inserted asphalt probably improved the water regime of plants during their vegetation.—Copyright 1975, Biological Abstracts, Inc.  
W77-00513

**THE CHANGE OF CLAY MATERIAL IN CHERNOZEMS UNDER RICE CULTIVATION, (IN RUSSIAN).**  
Moscow State Univ. (USSR). Dept. of Soil Science.  
For primary bibliographic entry see Field 2G.  
W77-00523

**MECHANISM OF INTERACTION OF WEAKLY MINERALIZED IRRIGATION WATER WITH SOIL, (IN RUSSIAN).**  
Moscow State Univ. (USSR). Dept. of Soil Science.  
For primary bibliographic entry see Field 2G.  
W77-00524

## 4. WATER QUANTITY MANAGEMENT AND CONTROL

### 4A. Control Of Water On The Surface

**APPLICATION OF A HYDROLOGIC MODEL TO THE PLANNING AND DESIGN OF STORM DRAINAGE SYSTEMS FOR URBAN AREAS.**  
Utah Water Research Lab., Logan.  
G. B. Shih, E. K. Israelsen, R. N. Parnell, Jr., and J. P. Riley.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-258 639. Price codes: A05 in paper copy, A01 in microfiche. Publication PRWG86-1, May 1976. 79 p, 46 fig, 5 tab, 18 ref, 2 append. OWRT B-048-UTAH(1). 14-31-0001-3341.

Descriptors: Hydrographs, Economic prediction, Water resources development, Management, Computer programs, \*Utah, \*Model studies, \*Planning, \*Design criteria, Storm drains, \*Storm runoff, \*Urban drainage, Urban runoff, Simulation analysis, Watersheds(Basins).  
Identifiers: Jordan River(Utah), Salt Lake County(Utah), \*Urban watersheds.

A generally applicable hybrid computer program is developed to simulate runoff from urban watersheds, and is applied to represent the outflow hydrographs of three urban watersheds located within Salt Lake County, Utah. The gaged outflow of the watersheds provided a means for comparing the observed and the simulated final outflow hydrographs. Each of the three watersheds was subdivided into spatial units or subzones, and the outflow hydrographs for each subzone were obtained by abstracting interception, infiltration, and depression storage from the rainfall hyetograph of each subzone. The resulting hydrograph outflow of each subzone then was routed to the Jordan River, the final outflow point of the three watersheds. The final hydrographs of the three watersheds were combined and compared with the gaged flow. The unique features of this model are its ability to (1) accept a wide range of input hyetographs; (2) accommodate variable loss rates; (3) combine subzone hydrographs; and (4) combine watershed hydrographs into a single runoff function. In addition to numerical output, graphs can be plotted for visual inspection. This characteristic enables designers and planners to use the model to examine quickly both the physical and economic impacts of various possible input conditions and management alternatives.  
W77-00004

**DAMS AND PEOPLE: GEOGRAPHIC IMPACT AREA ANALYSIS.**  
Kentucky Water Resources Research Inst., Lexington.  
For primary bibliographic entry see Field 6B.  
W77-00008

**URBAN STORMWATER DETENTION AND FLOW ATTENUATION.**  
For primary bibliographic entry see Field 5D.  
W77-00078

**SOURCE AND TRIBUTARY-SOURCE LINK LENGTHS IN NATURAL CHANNEL NETWORKS.**  
New South Wales Univ., Kensington (Australia). School of Geography.  
For primary bibliographic entry see Field 8B.  
W77-00084

**FLOAT CALIBRATION IN INTEGRATED-FLOAT TECHNIQUES.**  
Department of Scientific and Industrial Research, Taupo (New Zealand). Ecology Div.  
For primary bibliographic entry see Field 7B.  
W77-00088

**INTER-PLAN COMMUNICATION AND MOTIVATION STUDY. FINAL REPORT, FLORIDA BACKGROUND STUDY.**  
Sperry Urban Science Center, Washington, D.C.  
For primary bibliographic entry see Field 6B.  
W77-00098

**FLOOD HAZARD ANALYSIS: CROOKED RIVER, TOWN OF CASCO, TOWN OF NAPLES, CUMBERLAND COUNTY, MAINE.**  
Soil Conservation Service, Orono, Maine.  
Prepared for Casco and Naples, Maine, December 1974. 16 p, 4 fig, 21 plates, 3 tab.

Descriptors: \*Floods, \*Flood profiles, \*Flood plains, \*Maine, Streamflow forecasting, Peak discharge, Floodways, Flood protection, Non-structural alternatives, Control structures.  
Identifiers: \*Crooked River(ME), \*Casco(ME), \*Naples(ME), 100-year flood, Songo River(ME), 500-year flood.

Land use in the Crooked River Watershed is approximately 90% forest. Less than 1% of the land is urbanized or in recreational use, but this is expected to reach 2.8% by 1980. This watershed drains 152 square miles at its confluence with Songo River. Channel length in the study area is about 14 miles, from Tea Swamp to Sebago River. There is one dam in poor condition at Edes Falls. Fluctuation of the Sebago Lake level affects the stream bank erosion and flooding potential along lower reaches of the Songo and Crooked Rivers. There are no streamgages on Crooked River, but on the down-stream Sebago Lake, a high was recorded in 1936 which was considered a 50-year frequency event. Most floods occur in March through May and in November, the remainder being spread throughout the year. Projections on 10, 100 and 500 year frequency floods are presented in the form of flood profiles and flood plain maps. In a 100-year flood a peak discharge of 11,000 cubic feet per second is predicted for Crooked Creek at its confluence with Songo River. In a 500-year flood, a discharge of 14,800 cfs is anticipated. This report serves as a technical base upon which to formulate flood reduction measures, but does not detail such methods. A 1971 Maine law, 'Mandatory Zoning and Subdivision Control' requires municipal governments to adopt ordinances for shoreline areas. (Smith-North Carolina)  
W77-00100

**AN OVERVIEW OF THE IMPACT STUDY OF THE MCCLELLAN-KERR MULTIPLE PURPOSE ARKANSAS RIVER SYSTEM.**  
Institute for Water Resources (Army), Fort Belvoir, Va.  
For primary bibliographic entry see Field 6G.  
W77-00101

**FLOOD PLAIN INFORMATION: REPORT ON RANOCAS CREEK, BURLINGTON COUNTY, NJ (SUMMARY REPORT).**  
Army Engineer District, Philadelphia, Pa.  
Prepared for Burlington County Planning Board, April 1967. 12 p, 8 fig, 10 plates.

Descriptors: \*Floods, \*Flood profiles, \*Flood plains, \*Non-structural alternatives, \*New Jersey, Floodwater, Streamflow forecasting, Maximum probable flood, Historic floods, Peak discharge, Flood plain zoning, Building codes, Reservoirs, Diversion structures, Channel improvement, Floodproofing.

## Field 4—WATER QUANTITY MANAGEMENT AND CONTROL

### Group 4A—Control Of Water On The Surface

Identifiers: \*Rancocas Creek(NJ), Burlington County(NJ), Mount Holly(NJ), \*Flood plain management, Standard Project Flood, Intermediate Regional Flood, Subdivision regulations.

Information is given on one mile of Rancocas Creek, 22 miles of the South Branch Rancocas Creek, and 12 miles of the North Branch Rancocas Creek. Floodplains along these streams are low flat marshlands in the tidal reaches in some sections and low, sometimes wooded, areas in other sections. The most extensively developed area is in Mount Holly, NJ along the North Branch of Rancocas Creek. Between 1960 - 1990, population in Burlington County is expected to double and, therefore, pressure to develop floodplains will be great. Development, with its concomitant increase in impervious surfaces, will increase flood hazards. A flood in 1940 is considered the greatest flood because it produced record high flows and flood stages. Ten inches of rain fell causing dams at Taunton and Medford Lakes to fail, resulting in flooding downstream. Property damage in Mount Holly alone was \$129,000. Large floods generally occur in summer and early fall, however, lesser floods may occur at all times of the year. Maps and profiles give information on a 20-year flood, 100-year flood and Standard Project Flood. Flooding problems in this area can be compounded when high waters occur at times of high tide on the Delaware River. In 1944 the Corps of Engineers completed a \$283,700 flood control project which included channel improvements, a diversion channel and a cut-off channel. This protects the business section of Mount Holly. Local dams and reservoirs also provide a small amount of protection. Guidelines for floodplain management are presented. (Smith-North Carolina). W77-00102

**SOCIAL IMPACT ASSESSMENT: AN OVERVIEW,**  
Colorado State Univ. Fort Collins.  
For primary bibliographic entry see Field 6B.  
W77-00103

**FLOOD PLAIN INFORMATION: SOUTHAMPTON COUNTY, VIRGINIA.**  
Army Engineer District, Norfolk, Va.  
Prepared for Southampton County, Virginia. June 1975. 24 p, 6 fig, 25 plates, 6 tab.

Descriptors: \*Virginia, \*River forecasting, \*Flood profiles, \*Flood stages, \*Flood plains, Floods, Regional flood, Flood flow, Hurricanes, Historic floods, Flood data, Peak discharge.  
Identifiers: \*Standard Project Flood, \*Intermediate Regional Flood, Courtland(VA), \*Nottoway River(VA).

Except for the town of Courtland, properties along the Nottoway River are relatively undeveloped and consist of marsh, woodlands, farms and open space. These areas may come under pressure to develop, as the zone is very accessible by major highways. Southampton County is the leading hog producing county in Virginia and leads in peanut production in both the state and nation. The drainage area of the Nottoway River at its mouth is 1,695 sq mi. It joins the Blackwater River to form the Chowan River. The channel is generally well-defined and overbank areas are generally covered with vegetation. Floods occur in all seasons and result from intense rain or tropical hurricanes. Six large floods have occurred since 1940; the largest, in 1940, had a peak discharge of 48,000 cubic feet per second. Damaged were houses, roads, bridges and some deaths occurred. In an Intermediate Regional Flood (IRF) a peak discharge of 34,500 cfs and water velocities of 3.7 feet per second in the main channel and 1.6 ft/sec in the overbank area are expected. It is anticipated that it would take 68 hours to reach flood peak after flood stage is reached, with flood stage lasting 185 hours. A Standard Project Flood (SPF) would have a peak discharge of 54,000 cfs, slightly

higher than the 1940 flood. Water velocities would be 3.8 and 1.7 ft/sec in the main channel and overbank, respectively. Time of rise would be about 116 hours and flood stage would last 252 hours. During an ERF, 5 of 8 bridges would be obstructive to flow and 7 would be obstructive during the SPF. In either flood, approach roadways on 3 highways will be submerged before water reaches low steel elevations on bridges. There are no existing flood control structures. The 100-year flood plain is governed by the State Building Code. (Smith-North Carolina) W77-00104

**FLOOD PLAIN INFORMATION: RESURRECTION RIVER AND SALMON CREEK, ALASKA.**  
Army Engineer District, Anchorage, Alaska.  
Prepared for Kenai Peninsula Borough, Alaska. June 1975. 24 p, 12 fig, 18 plates, 3 tab.

Descriptors: \*Alaska, \*Floods, \*Flood profiles, \*Bank erosion, \*Flood plains, \*Tsunamis, Stream-flow forecasting, Maximum probable flood, River forecasting, Historic floods, Flood data, Peak discharge, Flood damage, Erosion, Snowmelt.  
Identifiers: \*Resurrection River(AK), \*Salmon Creek(AK), Seward(AK), 100-year flood, 500-year flood, Channel changes.

Properties along the streams are mostly residential, and open spaces in the flood plain are now under pressure to develop. Though population of Seward has declined in recent years to 1,891 in 1974, future growth is expected. Resurrection River is glacial fed with a steep gradient through its drainage area of about 170 sq mi. Salmon Creek, a tributary of Resurrection River, has a drainage area of 36 sq mi. It has a steep braided channel and has overflowed its banks several times in recent years. Floods usually occur from August through November or in Spring; primary cause of flooding is rapid runoff during heavy rains. Little historic flood data exist, though floods have been recorded on one or both rivers since 1946. In a 100-year flood, it is anticipated that peak flows on Resurrection River and Salmon Creek will be 55,000 and 16,000 cubic feet per second, respectively. Velocities of up to 10 feet per second in the main channel and 3 ft/sec in the overland area are expected. A 500-year flood would have a peak discharge of 82,000 cfs and 24,000 cfs on Resurrection River and Salmon Creek, respectively. Water velocities would be slightly higher than during the 100-year flood. Seward, located at the mouth of Resurrection River and at head of Resurrection Bay, is subject to riverine and coastal flooding. A tsunami like the one which occurred following the 1964 Alaska earthquake is rarer than the 500-year flood. The wave in 1964 caused extensive damage. Erosion of the alluvial material on the flood plain has been a problem in the past and is expected to be a problem in future floods. There are no existing flood control structures or flood plain management regulations in force. (Smith-North Carolina) W77-00105

**OPTIMAL DESIGN OF SINGLE RESERVOIR SYSTEM USING (DELTA) RELEASE POLICY,**  
California Polytechnic State Univ., San Luis Obispo. Dept. of Computer Science and Statistics. S. S. Luthra, and S. R. Arora.  
Water Resources Research, Vol. 12, No. 4, p 606-612, August 1976. 3 fig 5 tab, 4 ref.

Descriptors: \*Multiple-purpose reservoirs, \*Design, \*Reservoir releases, Water policy, Optimization, Inflow, Economics, Costs, Equations, Mathematical models, Systems analysis.  
Identifiers: \*Chance-constrained programming, Cost minimization, Linear decision rule, \*Reservoir capacity.

Reservoirs provide storage capacity which serves to match more ideally the demands and supplies of

water. The amount of storage required very critically depends upon the constraints on freeboard, minimum pool level, and upon the permissible limits on releases. Release policy also plays a very critical role. During recent years, one of the policies which has attracted much attention is the linear decision rule policy. This policy passes on the variability of a particular period's inflow to the next period's release. Another release policy is presented, the delta release policy, where delta is a parameter whose value distributes the effects of inflow variability between the releases and the pool level. It is shown that delta release policy requires smaller reservoir capacity than that obtained by the linear decision rule policy. The optimization problem is formulated as a chance-constrained programming problem for minimizing the cost of the reservoir. (Bell-Cornell) W77-00109

**THE RELEVANCE OF TECHNOLOGICAL CHANGE IN LONG TERM WATER RESOURCE PLANNING,**  
Colorado Univ., Boulder. Dept. of Economics.  
For primary bibliographic entry see Field 6B.  
W77-00113

**ECONOMIC OPTIMUM RECORD LENGTH,**  
Nielsen and Rauschenberger A/S, Lyngby (Denmark).  
S. Jacobi.  
Nordic Hydrology, Vol. 6, No. 1, p 28-42, 1975. 5 fig, 9 ref.

Descriptors: \*Stochastic processes, \*Optimization, \*Hydrology, \*Design, \*Decision making, \*Reservoirs, Monte Carlo methods, Simulation analysis, Storage, Projects, Sediment load, Marginal costs, Marginal benefits, Data collections, Mathematical models, Equations, Systems analysis.  
Identifiers: \*Cost minimization, \*Record length, \*Expected opportunity loss, \*Uncertainty, \*Bayesian design approach.

Uncertainty in hydrologic design parameters is reflected as an increase in expected project costs. The Bayesian or statistical decision approach produces a minimum-cost decision for a specific design, yielding the expected opportunity loss, EOL, a measure of the uncertainty inherent in the decision process. The uncertainty stems from the fact that the population value of the design parameters is unknown. Additional information can be obtained by collecting more data, and the value of these data is measured by the decrease in EOL. But there are costs involved in getting additional data: the cost of continued data collection and the costs of delaying the construction of the project (benefits foregone). The expected economic optimum record length is defined at the point where the marginal benefits of additional data are equal to the marginal costs of obtaining those data. The theory is applied to sediment load data used to design the sediment storage portion of a reservoir. Based on an economic efficiency criterion, the expected optimum record length is found to be 12 years, given that 5 years of data are available at the time of the analysis. Objectives like environmental quality and social benefits are disregarded in this analysis. (Bell-Cornell) W77-00117

**A COMPUTERIZED SYSTEM FOR WILD LAND USE PLANNING AND ENVIRONMENTAL IMPACT ASSESSMENT,**  
Washington Univ., Seattle. Coll. of Forest Resources.  
For primary bibliographic entry see Field 6G.  
W77-00119

**A STABLE ESTIMATOR FOR LINEAR MODELS I. THEORETICAL DEVELOPMENT AND MONTE CARLO EXPERIMENTS,**  
Pavia Univ. (Italy).



L. Natale, and E. Todini.

Water Resources Research, Vol. 12, No. 4, p 667-671, August 1976. 5 fig, 8 ref.

**Descriptors:** \*Hydrologic systems, \*Linear programming, \*Estimating, Optimization, Simulation analysis, Monte Carlo method, Constraints, Hydrologic data, River basins, Networks, Drainage, Input-output analysis, Mathematical models, Systems analysis.

**Identifiers:** \*Black box parameter estimation, Quadratic programming, Error minimization, Sensitivity.

Instant unit hydrograph (IUH) type linear models have been widely used to simulate many hydrologic systems. Unfortunately, the classical parameter estimators used to calibrate this type of model often fail to give a reliable and meaningful solution. It has been suggested that a set of constraints that can be deduced from the physics of the hydrologic system be imposed on the IUH in order to reduce the high sensitivity of the classical estimators to errors in the available data. Therefore, a mathematically correct constrained estimator has been devised, and its solution is obtained by using quadratic programming. The higher degree of efficiency of this estimator (smaller dispersion of the estimates about the true value) is shown numerically through Monte Carlo experiments. (Bell-Cornell)

W77-00123

**MATHEMATICAL MODEL FOR PREDICTING THE CONSOLIDATION OF DREDGED MATERIAL IN CONFINED DISPOSAL AREAS.** Army Engineer Waterways Experiment Station, Vicksburg, Miss. Soils and Pavements Lab.

For primary bibliographic entry see Field 5B.

W77-00167

**HYDROLOGIC ENGINEERING METHODS FOR WATER RESOURCES DEVELOPMENT, VOLUME 3, HYDROLOGIC FREQUENCY ANALYSIS.**

Hydrologic Engineering Center, Davis, Calif.

L. R. Beard, and A. J. Fredrich.

Available from the National Technical Information Service, Springfield, Va 22161 as AD-A017 433. Price codes: A08 in paper copy, A01 in microfiche. Report HEC-IHD-300, April 1975. 143 p, 38 fig, 6 tab, 33 ref.

**Descriptors:** \*Hydrology, \*Analytical techniques, \*Statistical methods, Data processing, Statistics, Frequency analysis, Frequency curves, Flood frequency, Runoff, Surface runoff, Forecasting, Correlation analysis, Probability, Hydrologic data, Climatology.

**Identifiers:** \*Hydrologic engineering.

Statistical analysis as applied in hydrologic engineering consists of (1) estimating the future frequency or probability of hydrologic events based on information contained in hydrologic records, and (2) correlating interrelated hydrologic variables. In probability analyses, statistical methods permit coordination of observed data to yield a more accurate estimate of future frequencies than is indicated by the observed data. In correlation analyses, statistical methods provide means for deriving the best relationship for predicting the value of one variable from known value of other variables. The volume described and illustrates applications of statistical analysis in hydrologic engineering. The volume included the following items: (1) A review of the basic concepts of probability that are applicable in hydrologic engineering, with a guide to supplemental reading for further study, (2) Presentation of detailed computation procedures and supporting justification and computation aids for derivation of probability or frequency estimates based on analysis of hydrologic records that have been adjusted to be consistent with selected reference base conditions, and (3) A summary of procedures for

developing 'regionalized' hydrologic frequency estimates, based on analyses of hydrologic records available at stream gaging stations, adjusted to provide generalized flood-frequency relations that are considered most representative of long-period hydrologic characteristics in various drainage areas in the region. (See also W74-11231, W74-11232, and W75-02283.) (Sims-ISWS)

W77-00169

**OFFSHORE INDUSTRIAL-PORT ISLANDS.** Delaware Univ., Newark. Coll. of Marine Studies. For primary bibliographic entry see Field 5G.

W77-00176

**BEWARE THE WRATH OF OSIRIS.**

J. Elkington.

New Scientist, Vol. 68, No. 979, p. 626-628, 1975.

**Descriptors:** \*Africa, \*Deltas, \*Land reclamation, \*Wetlands, Arid lands, Environmental effects, Planning, Fisheries, Irrigation, Aquaculture, Water pollution, Monitoring.

**Identifiers:** \*Egypt, Nile River(Egypt), Lake Manzala(Egypt).

Agriculturally productive land is probably the most important physical constraint determining Egypt's potential growth. Previous reclamation efforts have involved the desert; now the northern wetlands are being considered. Construction of the Aswan High Dam caused the water table of the Nile Delta to rise and nutrient content of the water and sardine catches to decrease. Planning responsibilities for the wetland area are fragmented, especially for the Lake Manzala area. Land reclamation might require twenty years before cultivation due to high salinity, it would destroy a major fishing ground, reduce fish spawning grounds, destroy wetland flora and fauna, affect bird migration routes, and remove avian insectivorous species. Use of the lake's water for irrigation, if salinity were reduced, would also have ecological effects. Lake Manzala now supplies 25% of Egypt's annual fish consumption. Aquaculture experiments are being conducted. Pollution is a significant factor in determining the feasibility of either fish farming or irrigation. Environmental management with an effective monitoring system is an urgent priority as large scale land reclamation is ecologically irreversible. (Buchanan-Davidson-Wisconsin)

W77-00177

**USING LINEAR PROGRAMMING TO EVALUATE AGRICULTURAL FLOOD CONTROL PROJECTS.**

Economic Research Service, Berkeley, Calif. Natural Resource Economics Div.

For primary bibliographic entry see Field 3F.

W77-00180

**UNITED STATES COAST PILOT 4 - ATLANTIC COAST FROM CAPE HENRY TO KEY WEST.**

National Ocean Survey, Rockville, Md. Fourteenth Edition, July 1976, 234 p, 2 fig, 21 tab, append.

**Descriptors:** \*Navigation, \*Navigable waters, \*Coasts, Charts, Rivers and Harbors Act, Transportation, North Carolina, South Carolina, Georgia, Florida, Virginia, \*Southeast US.

**Identifiers:** Intracoastal waterways, Waterways(Transportation), Navigable canals, Navigational charts, \*Southeast US Coast.

The National Ocean Survey Coast Pilots are a series of eight nautical books that cover a wide variety of information important to navigators of the United States coastal and intracoastal waters. Most of this information cannot be shown graphically on the standard nautical charts and is not readily available elsewhere. Coast Pilot subjects include navigation regulations, outstanding land-

marks, channel and anchorage peculiarities, dangers, weather, ice, freshets, routes, pilotage, and port facilities. The Coast Pilot is corrected through the dates of Notices to Mariners shown on the title page and should not be used without references to the Notices to Mariners issued subsequent to those dates. This volume of Coast Pilot 4, cancels the 13th (July 1975) Edition. Details are given for the following localities: Cape Henry to Key West, Cape Henry to Cape Lookout, Cape Lookout to Cape Fear, Cape Fear to Charleston Harbor, Charleston Harbor to Savannah River, Savannah River to St. Johns River, St. Johns River, St. Johns River to Miami, Miami to Key West and Intracoastal Water-way, Atlantic Section. (NOAA)

W77-00278

**UNITED STATES COAST PILOT 5 - ATLANTIC COAST FROM GULF OF MEXICO, PUERTO RICO, AND VIRGIN ISLANDS.**

National Ocean Survey, Washington, D.C.

Ninth Edition, July 1976. 348 p, 2 fig, 21 tab, append.

**Descriptors:** \*Navigation, \*Navigable waters, \*Coasts, Charts, Rivers and Harbors Act, Transportation, \*Gulf of Mexico, \*Puerto Rico, \*Virgin Islands, Mississippi River, Inland waterways, Southeast US.

**Identifiers:** \*Intracoastal waterways, Waterways(Transportation), Navigable canals, Navigational charts, \*Gulf coast.

The National Ocean Survey Coast Pilots are a series of eight nautical books that cover a wide variety of information important to navigators of the United States coastal and intracoastal waters. Most of this information cannot be shown graphically on the standard nautical charts and is not readily available elsewhere. Coast Pilot subjects include navigation regulations, outstanding landmarks, channel and anchorage peculiarities, dangers, weather, ice, freshets, routes, pilotage, and port facilities. The Coast Pilot is corrected through the dates of Notices to Mariners shown on the title page, and should not be used without reference to the Notices to Mariners issued subsequent to those dates. This volume of Coast Pilot 5, cancels the 8th (July 1975) Edition. Details are given for the following localities: Gulf of Mexico, Key West to Tampa Bay, Tampa Bay to Apalachee Bay, Apalachee Bay to Mobile Bay, Mobile Bay to Mississippi River, Mississippi River to Sabine Pass, Sabine Pass to San Luis Pass, San Luis Pass to the Rio Grande, Intracoastal Waterway, Gulf Section, Puerto Rico, and the Virgin Islands. (NOAA)

W77-00279

**ECONOMICS OF INCREASED MOBILITY FROM TILE DRAINAGE.**

Mosul Univ. (Iraq). Coll. of Engineering.

For primary bibliographic entry see Field 3F.

W77-00313

**ANNOTATED BIBLIOGRAPHY ON TRICKLE IRRIGATION.**

Colorado State Univ., Fort Collins. Dept. of Agricultural Engineering.

For primary bibliographic entry see Field 3F.

W77-00315

**PERFORMANCE AND EVALUATION OF COMBINED MOLE-TILE DRAIN SYSTEM IN HEAVY SOILS.**

Utah State Univ., Logan.

K. Unhanand, and K. Tuamsangiem.

International Commission On Irrigation and Drainage Bulletin, p 36-52, January 1975. 24 fig, 15 ref.

**Descriptors:** \*Drainage, \*Drainage effects, \*Drainage practices, \*Drainage system, \*Drains, Soils, Soil water, \*Tide drains.

## Field 4—WATER QUANTITY MANAGEMENT AND CONTROL

### Group 4A—Control Of Water On The Surface

A field experiment investigated the performance and cost of the combined mole-drain systems in heavy soils in comparison with a similar tile drain system. Three experimental plots consisted of a tile-drained plot, a combined (single mole) drained plot and a combined (double mole) drained plot. They were constructed with a tile drain spacing of 37 metres (120 feet) and a mole drain spacing of 1.83 metres (6 feet). The experimental results show that the combined systems were more effective than the drain system in lowering the water table. The difference in the effectiveness of the single mole drains and double mole drains was not distinctly apparent. No deterioration of the mole drains was detected during the two year test period. The cost analysis indicated that the annual cost of the combined systems is always less than that of an equivalent tile drain system even if the mole drains in the combined system have to be redrawn every year. (Skogerboe-Colo St). W77-00316

**MAPPING RUNOFF-PRODUCING ZONES IN HUMID REGIONS,**  
McGill Univ., Montreal (Quebec). Dept. of Geography.  
T. R. Moore, and C. H. Taylor.  
Journal of Soil and Water Conservation, Vol. 31, No. 4, p 160-164, July-August 1976. 5 fig, 27 ref.

Descriptors: \*Mapping, \*Runoff, Zoning, Humid areas, Hortons law, Hydrology, Overland flow, River flow, Land management, Rainfall intensity. Identifiers: \*Runoff-producing zones, Horton infiltration approach, River discharge, Infiltration capacity, Prediction technique, Saturated areas, Soil morphology.

In undisturbed humid regions, the saturated areas of a catchment play an important role in determining storm runoff through subsurface storm flow, return flow, and direct precipitation onto saturated areas. Field mapping showed that the extent of the saturated area varies seasonally from 15 to 51%. The saturated areas also served an important function in determining stream water quality and land capability. The best method of evaluating the size, location, and variation of saturated areas was by repeated field mapping. Topography had a major influence on the distribution of the saturated area. Soil morphology was a more useful criterion. From the distribution and type of gley morphology within a soil profile, the soil water regime and water table depth could be estimated. A number of relatively simple observations indicated fairly well the distribution of saturated areas in catchments. Estimates could also be derived from soil moisture budgets of typical types and hydrograph analysis. Each method had different applicability in different types of catchments. (Roberts-ISWS) W77-00368

**LINK SLOPE DISTRIBUTION IN CHANNEL NETWORKS,**  
Brock Univ., St. Catharines (Ontario). Dept. of Geological Sciences.  
For primary bibliographic entry see Field 2A. W77-00370

**SIMILARITY OF THE MEAN MOTION OF FLUID PARTICLES DISPERSING IN A NATURAL CHANNEL,**  
Geological Survey of Canada, Ottawa (Ontario).  
For primary bibliographic entry see Field 5B. W77-00371

**THE GENERATION OF RUNOFF FROM SUBARCTIC SNOWPACKS,**  
Washington Univ., Seattle. Dept. of Geological Sciences.  
For primary bibliographic entry see Field 2C. W77-00372

**ENERGY BALANCE COMPUTATIONS OF SNOWMELT IN A SUBARCTIC AREA,**  
Scarborough Coll., Toronto (Ontario) Div. of Social Sciences-Geography.  
For primary bibliographic entry see Field 2C. W77-00373

**SOME DIFFERENCES BETWEEN DISTRIBUTING AND BRAIDING CHANNELS,**  
Macquarie Univ., North Ryde (Australia). School of Earth Sciences.  
For primary bibliographic entry see Field 2E. W77-00376

**DATA PROCESSING: A REVIEW OF THE ROLE OF THE MINISTRY OF WORKS AND DEVELOPMENT,**  
Ministry of Works, Wellington (New Zealand). Water and Soil Div.  
For primary bibliographic entry see Field 7C. W77-00378

**EFFECT OF OSMOTIC SUCTION ON THE GERMINATION OF WARM SEASON GRASSES, (IN JAPANESE),**  
Kyushu Agricultural Experiment Station, Kumamoto (Japan).  
For primary bibliographic entry see Field 2I. W77-00422

**EFFECT OF SOIL WATER SUCTION ON THE GERMINATION AND EMERGENCE OF WARM SEASON GRASSES, (IN JAPANESE),**  
Kyushu Agricultural Experiment Station, Kumamoto (Japan).  
For primary bibliographic entry see Field 2I. W77-00423

**HYDROLOGIC UNIT MAP--1974, STATE OF IOWA**  
Geological Survey, Reston, Va.  
For primary bibliographic entry see Field 7C. W77-00425

**MEAN ANNUAL RUNOFF IN THE UPPER OHIO RIVER BASIN, 1941-70, AND ITS HISTORIC VARIATION,**  
Geological Survey, Harrisburg, Pa.  
For primary bibliographic entry see Field 2E. W77-00428

**HYDROLOGIC UNIT MAP--1974, STATE OF WYOMING.**  
Geological Survey, Reston, Va.  
For primary bibliographic entry see Field 7C. W77-00429

**SURFACE WATER SUPPLY OF THE UNITED STATES, 1966-70: PART 4. ST. LAWRENCE RIVER BASIN--VOLUME 2. ST. LAWRENCE RIVER BASIN BELOW LAKE HURON.**  
Geological Survey, Reston, Va.  
Available from Branch of Distribution, USGS, 1200 S. Eads St., Arlington, Va. 22202, \$5.50. Water-Supply Paper 2112, 1976. 738 p, 1 fig.

Descriptors: \*Hydrologic data, \*Surface waters, \*Streamflow, \*Lakes, \*St. Lawrence River, River basins, Indiana, Michigan, New York, Ohio, Pennsylvania, Vermont, Runoff, Discharge (Water), Gaging stations, Flow measurement, Average flow, Reservoir stages. Identifiers: \*St. Lawrence River basin, Maximum discharges, Minimum discharges.

This is one of 37 reports presenting records of stage and discharge of streams, and of stage and contents of lakes and reservoirs in the United States during the 1966-70 water years; it contains the records for gaging stations and partial-record

stations in the St. Lawrence River basin below Lake Huron. This report is one of the second series of water-supply papers to be published on a 5-year basis. The first series covered the 5-year period October 1, 1960, to September 30, 1965. This series covers the period October 1, 1965, to September 30, 1970. The daily table for stream-gaging stations gives the mean discharge for each day and is followed by monthly and yearly summaries of total, average, maximum, and minimum discharges. (Woodard-USGS) W77-00431

**DEVELOPMENT OF A STANDARD RATING FOR THE PRICE PYGMY CURRENT METER,**  
Geological Survey, Jackson, Miss.  
For primary bibliographic entry see Field 7B. W77-00432

**FLOODS OF MARCH-APRIL 1973 IN SOUTHEASTERN UNITED STATES,**  
Geological Survey, Reston, Va.  
For primary bibliographic entry see Field 2E. W77-00434

**WATER RESOURCES DATA FOR ALABAMA, WATER YEAR 1975.**  
Geological Survey, Tuscaloosa, Ala.  
For primary bibliographic entry see Field 7C. W77-00435

**ESTIMATION AND SIMULATION OF SHEET RUNOFF,**  
Commonwealth Scientific and Industrial Organization, Canberra (Australia). Div. of Land Use Research.  
J. R. Ives, C. W. Rose, B. H. Wall, and B. W. R. Torrsell.  
Australian Journal of Soil Research, Vol 14, No 2, p 129-138, June 1976. 3 fig, 2 tab, 23 ref, append.

Descriptors: \*Model studies, \*Surface runoff, \*Water balance, \*Soil moisture, Water storage, Water loss, Antecedent moisture content, Storm runoff, Pastures, Rainfall-runoff relationships, Plant growth, Australia, Estimating.

Many water use models assume that surface runoff is negligible or that it occurs only after a defined soil water storage has been filled. In areas where rainfall is characterized by high intensity storms of short duration, such as the dry monsoonal area of northern Australia, such models overestimate soil water storage. A study is reported which aimed to estimate sheet runoff in such a situation and to demonstrate its importance by evaluating the improvement achieved when a runoff function is included in a water balance routine of a simulation model. Runoff was estimated for a Townsville stylo - annual grass pasture with a 1% slope using neutron hydrometry supplemented by gravimetric soil sampling, both carefully timed with respect to the rainfall event. An empirical model relating sheet runoff to antecedent soil moisture content and the standard daily rainfall total was developed and incorporated into an existing growth model which included a water balance routine. The soil water values simulated with the runoff model included were significantly closer to experimental values than when runoff was assumed to be zero; this improvement was consistent with an improvement in subsequent dry matter simulation. (CSIRO) W77-00439

**MAGNITUDE AND FREQUENCY OF FLOODS IN NORTH CAROLINA: TECHNIQUE FOR ESTIMATING THE MAGNITUDE AND FREQUENCY OF FLOODS ON NATURAL STREAMS IN NORTH CAROLINA,**  
Geological Survey, Raleigh, N. C.  
For primary bibliographic entry see Field 2E. W77-00480

**FLOODFLOW CHARACTERISTICS AT PROPOSED BRIDGE SITE ON FISHKILL CREEK, FISHKILL, NEW YORK,**  
Geological Survey, Albany, N.Y.  
For primary bibliographic entry see Field 4C.  
W77-00483

**LAKES MARION-MOULTRIE STREAM SYSTEM INVESTIGATION: PART II-SIMULATION STUDIES,**  
Geological Survey, Columbia, S.C.  
H. H. Jeffcoat, M. E. Jennings, D. L. Collins, and J. O. Shearman.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-255 713. Price codes: A03 in paper copy, A01 in microfiche.  
Water-Resources Investigations 76-11, March 1976. 26 p, 7 fig, 5 tab, 2 ref.

Descriptors: \*Streamflow forecasting, \*Reservoirs, Hydrology, \*Simulation analysis, \*Water balance, Methodology, Model studies, Hydrologic data, Input-output analysis, Reservoir operation, \*South Carolina, \*Reservoir operations.  
Identifiers: \*Lakes Marion-Moultrie reservoir(SC).

A stream-reservoir model was developed to simulate the operation of the Lakes Marion-Moultrie, South Carolina, reservoir system. The reservoir system is operated under the assumption of a 3-day prior knowledge of inflows. This information is attainable from the operational reservoir-inflow forecasting model developed in the Part I report. The model, developed for this part of the study, incorporates an inflow component, a diversion-canal component, and a reservoir system component and is capable of evaluating the performance of the reservoir system for a variety of operating rule conditions. All model components were verified using observed reservoir input and output data for a 6-year (1967-72 water years) period. In addition, a long-term 31-year simulation under present rule of operation was performed and the results summarized statistically. The model may be used for simulating other rule curves of operation for planning studies of reservoir system performance. (See also W75-05646) (Woodard-USGS)  
W77-00488

**THE BROADLEAF EVERGREEN FORESTS OF JAPAN, (IN GERMAN),**  
T. Suzuki.  
Phytocoenologia. 2(3/4), p 293-300, 1975.

Descriptors: \*Asia, \*forests, Rain forests, Forest management.  
Identifiers: \*Broadleaf evergreen forests, \*Evergreen forests, Fern, Ficus-retusa, Ficus-wightiana, \*Japan, Liana, Machilus-thunbergii, Quercus-phillyraeoides, \*Lawraceae, \*Fagaceae.

Rainy climate continues from the subtropics northward to the cool-temperate region in Japan. The broad-leaved evergreen forests of Japan have many characteristics of the rain-forest, such as richness in lianas, epiphytes and ferns. The dominant genera, within which evergreen and deciduous species have differentiated during the climatic alternations since the Tertiary, are for the most endemic or have specified endemic taxa in Sino-Japanese Region. It is a unique character of this east Asiatic and southeast Asiatic broad-leaved evergreen forest that the Lauraceae and the Fagaceae grow in a community. Because the route of migration was 1 way, along the axis of the Archipelago, this class-group is monotypic with only 1 class, 1 order and 1 alliance. The alliance of Shion sieboldii is the only one of the class-group that has reached the seashore. Shion sieboldii comprises 4 suballiances. Suballiance of Quercion phylliraeoides is physiognomically a sclerophyllous forest, but it is floristically a suballiance of the Shion sieboldii. Quercus phylliraeoides itself

is a relict of the Tertiary warm zephytic flora. In this suballiance the Lauraceae are separated from the Fagaceae. The typical suballiance has no clear character species for itself, but is the main part of the alliance. It is composed of 5 associations. Cyclobalanopsis stenophyllae develops near the upper limit of the alliance. It has 3 associations, among which the Aucubo-cyclobalanopsis stenophyllae is the only one differentiated under the snowy climate of the Japan sea coast. The last Machilion thunbergii is hygrophilous and shade-tolerant. In the south it is the most thermophilous of the all suballiances; it forms subtropical stand near the boundary to the Ficus wightiana and F. retusa forests, but it is the suballiance that can attain the northernmost limit of the alliance, because Machilus thunbergii can utilized more efficiently the lateral light from the lower position of the sun and refraction from the sea surface.—Copyright 1976, Biological Abstracts, Inc.  
W77-00499

**WATER BALANCE OF STIPA PENNATA SPP. ERIOCAULIS, STIPA CAPILLATA AND FESTUCA VALLESIAE IN THE STEPPE REGION OF THE UPPER VINSCHAGAU, (IN GERMAN),**  
For primary bibliographic entry see Field 2D.  
W77-00505

#### 4B. Groundwater Management

**IMPACT OF LAND DISPOSAL OF SLUDGES ON GROUNDWATER,**  
Geraghty and Miller. Port Washington, N.Y.  
For primary bibliographic entry see Field 5B.  
W77-00031

**A CASE STUDY OF CITIZEN PARTICIPATION IN RESOURCE PLANNING: THE CRAWFORD COUNTY CRITICAL RESOURCE INFORMATION WORKSHOP.**  
Wisconsin Univ., Madison. Inst. for Environmental Studies.  
For primary bibliographic entry see Field 6B.  
W77-00171

**NITROGEN IN SOIL CORES AND GROUND WATER UNDER ABANDONED CATTLE FEEDLOTS,**  
Agricultural Research Service, Lincoln, Nebr. Animal Waste Management Research Unit.  
For primary bibliographic entry see Field 5B.  
W77-00365

**GEOLOGIC NITROGEN IN PLEISTOCENE LOESS IN NEBRASKA,**  
Nebraska Univ., Lincoln. Dept. of Agronomy.  
For primary bibliographic entry see Field 5B.  
W77-00366

**TOWARDS A COMPUTER-BASED INFORMATION-RETRIEVAL SYSTEM FOR GROUND-WATER DATA,**  
New Zealand Geological Survey, Christchurch.  
For primary bibliographic entry see Field 7C.  
W77-00377

**HYDROGEOLOGIC DATA FROM THE GREAT BEND PRAIRIE, SOUTH-CENTRAL KANSAS,**  
Geological Survey, Lawrence, Kans.  
L. E. Stulken, and S. W. Fader.  
Kansas Geological Survey, Lawrence, Basic-Data Series Ground-Water Release No 5, 1974. 50 p, 1 fig, 1 plate, 4 tab.

Descriptors: \*Hydrologic data, \*Groundwater resources, \*Water quality, \*Aquifer characteristics, \*Well data, Hydrogeology, Water supply, Water yield, Water levels, Water users, Lithologic logs, Chemical analysis, Great Plains.

Identifiers: \*Great Bend Prairie(Kans).

The investigation of the geology and ground-water resources of the Great Bend Prairie, an area of 5,400 square miles which includes all of Kingman, Kiowa, Pratt, Stafford, and parts of Barber, Barton, Edwards, Pawnee Reno, and Rice Counties, south-central Kansas, was made during 1973-74. The study is part of the cooperative program between the Kansas Geological Survey and the U.S. Geological Survey, with data and support from the Division of Water Resources of the Kansas State Board of Agriculture and the Division of Environment of the Kansas State Board of Health and Environment. Records of 1,508 wells in the ten counties are presented. Included are 1,234 irrigation, 25 domestic or stock, 172 industrial or public supply, and 77 other wells. One hundred fifty-two chemical analyses of water from 148 representative wells are listed. Lithologic logs of 127 test holes also are included. (Woodard-USGS)  
W77-00426

**GROUND-WATER LEVELS IN THE UNITED STATES, 1970-74: SOUTH-CENTRAL STATES.**  
Geological Survey, Reston, Va.  
Available from Branch of Distribution, USGS 1200 S. Eads St. Arlington, Va., 22202, price \$2.50.  
Water-Supply Paper 2172, 1976. 172 p, 5 fig.

Descriptors: \*Water levels, \*Groundwater, \*Arkansas, \*Louisiana, \*Oklahoma, \*Texas, Basic data collections, Water wells, Observation wells.  
Identifiers: \*South-central states.

Water-level measurements in this report of south-central states, for 1970-74, are given in feet with reference to either mean sea level or land-surface datum. Mean sea level is the datum plane on which the national network of precise levels is based; land-surface datum is a datum plane that is approximately at land surface at each well. If known, the altitude of the land-surface datum above mean sea level is given in the well description. The height of the measuring point above or below land-surface datum is given in each well description. Water levels in wells equipped with recording gages are reported for every fifth day and the end of each month. (Woodard-USGS)  
W77-00430

**WATER RESOURCES DATA FOR ALABAMA, WATER YEAR 1975.**  
Geological Survey, Tuscaloosa, Ala.  
For primary bibliographic entry see Field 7C.  
W77-00435

**EFFECTS OF NEAR-WELL PERMEABILITY VARIATION ON WELL PERFORMANCE,**  
New South Wales Univ., Kensington (Australia). Water Research Lab.  
C. R. Dudgeon, and P. S. Huyakorn.  
Australian Water Resources Council, Canberra, Technical Paper No. 18, 1976. 132 p, 52 fig, 23 ref, 4 append.

Descriptors: \*Water wells, \*Water yield, \*Aquifers, \*Permeability, Groundwater movement, Specific capacity, Drawdown, Pumping.

Field evidence has shown that the specific capacity of a pumped well can be greatly affected by permeability variations which occur in a zone immediately surrounding the well: for instance, by the invasion of drilling fluids to form a mud cake. A theoretical investigation is reported into the effect of such a phenomenon on the production capacity and drawdown of fully and partially penetrating wells which are screened in a confined aquifer. A method is presented for determining the average coefficient of permeability in the affected zone and the radial extent of the zone. Numerical solutions of several transient and steady flow cases were obtained using finite element analysis.



## Field 4—WATER QUANTITY MANAGEMENT AND CONTROL

### Group 4B—Groundwater Management

The results are presented in graphical form which enables a parametric study of dimensionless relationships to be conducted readily. Detailed relationships of the results are given in appendices. (CSIRO)  
W77-00437

**DRILLING MUD INVASION OF UNCONSOLIDATED AQUIFER MATERIALS,**  
New South Wales Univ., Kensington (Australia).  
Water Research Lab.  
For primary bibliographic entry see Field 8B.  
W77-00438

**GROUND-WATER DISCHARGE FROM THE EDWARDS AND ASSOCIATED LIMESTONES, SAN ANTONIO AREA, TEXAS, 1975,**  
Geological Survey, Austin, Tex.  
R. A. Rappmund.  
Edwards Underground Water District, San Antonio, Texas, Bulletin 35, July 1976. 7 p, 1 tab, 15 ref.

Descriptors: \*Water yield, \*Groundwater, \*Limestones, \*Aquifers, \*Texas, \*Water wells, \*Springs, Data collections, Discharge(Water), Fluctuations, Annual.  
Identifiers: \*San Antonio area(Tex), \*Edwards limestone(Tex).

The estimated total discharge from wells and springs in the Edwards and associated limestones in the San Antonio area, Texas, during 1975 was 868,200 acre-feet, which is the record high for the period 1934-75. The total discharge from wells and springs in 1975 was about 2 percent more than in 1974 and about 55 percent more than the average for 1934-74. About 38 percent of the total discharge was from wells, and approximately two-thirds of this amount was from wells in Bexar County. The discharge from wells in 1975 was 10 percent less than in 1974; springflow increased by about 12 percent. The discharge from springs was compiled from reports of gages operated by the U.S. Geological Survey at points of discharge. Pumpage for agriculture was estimated from records of power consumption and irrigated acreage. Records of the annual canvass of pumpage in the San Antonio area by the Texas Water Development Board were used to compile municipal, military and industrial usage. (Woodard-USGS)  
W77-00479

**DIGITAL SIMULATION OF A BASALT AQUIFER SYSTEM, WALLA WALLA RIVER BASIN, WASHINGTON AND OREGON,**  
Geological Survey, Tacoma, Wash.  
R. D. Mac Nish, and R. A. Barker.  
Washington Department of Ecology, Olympia, Water-Supply Bulletin 44, 1976. 51 p, 19 fig, 1 plate, 3 tab, 14 ref.

Descriptors: \*Model studies, \*Aquifer systems, \*Aquifer characteristics, \*Pumping, Washington, Oregon, Water yield, \*Water demand, Water utilization, Water levels, Transmissivity, Hydrogeology, Projections, Evaluation, Mathematical models, Computer models, River basins, \*Simulation analysis, Groundwater.  
Identifiers: \*Walla Walla River basin(Wash-Oreg).

A digital (mathematical) model utilizing an alternating-direction implicit procedure simulates the hydraulic response to 72 years of pumping stress of a basalt aquifer system underlying the 1,758-square-mile Walla Walla River basin in Washington and Oregon. The modeled aquifer system is sandwiched between an underlying basalt-aquifer zone and an overlying aquifer zone composed of gravel and clay in the central lowland part of the basin and of basalt elsewhere. A water budget of the aquifer system before pumping stress began in about 1900 was computed by steady-state simulation. For this simulation the aquifer received 132,000 acre-feet of water per year, with 114,000

acre-feet entering from the principal recharge area, the Blue Mountains, on the southeastern border of the basin. Annual discharge rates were 97,500 acre-feet laterally to the Snake and Columbia Rivers and 34,500 acre-feet to adjacent aquifers, which also eventually drain to the two rivers. By 1945 pumping stress had reached about 5,000 acre-feet per year. A large increase in irrigation demand over the next 20 years increased the pumpage to 20,000 acre-feet per year and caused declines of as much as 135 feet from the 1900 water levels. Simulation of the effects of pumping indicated that by 1972 the water budget of the basalt aquifer system showed a net increase of flow from the recharge areas (6,500 acre-feet per year) and reduction in both lateral outflow (8,500 acre-feet per year) and discharge to adjacent aquifers (12,500 acre-feet per year). (Woodard-USGS)  
W77-00481

**DIGITAL-MODEL ANALYSIS TO PREDICT WATER LEVELS IN A WELL FIELD NEAR COLUMBUS, INDIANA,**  
Geological Survey, Indianapolis, Ind.  
M. Planter.  
Available from National Technical Information Service, Springfield, VA 22161 as PB-255 909/As. Price codes: A02 in paper copy, A01 in microfiche. Water-Resources Investigations 76-63, May 1976. 15 p, 7 fig, 1 tab, 4 ref.

Descriptors: \*Model studies, \*Water levels, \*Projections, \*Aquifer characteristics, \*Groundwater resources, \*Indiana, Digital computers, Water supply, Water demand, Drawdown, Well resources, \*Indiana, Digital computers, Water supply, Water demand, Drawdown, Well spacing, Water table aquifers, Groundwater barriers, Hydrologic data, Hydrogeology.  
Identifiers: Columbus area(Ind).

Columbus, Indiana, obtains its water supply from six municipally owned wells southwest of the city. The wells are screened in an outwash sand and gravel aquifer that was deposited by glacial melt water in a preglacial bedrock valley. The well field is midway between the East Fork White River and the western edge of the valley. A digital model was used to determine the effects of two pumping plans on the outwash sand and gravel aquifer. In pumping plan 1, a continuous pumping rate of 1,400 gallons per minute (gpm) for 10 years in each of the city's six existing wells was simulated with the model. Model results of plan 1 indicate that the water levels in the area of the well field would be lowered more than 20 ft and that drawdowns in the wells would approach 35 ft after 10 years' pumping. Pumping plan 2 had two stages of pumping. In the first, a continuous pumping rate of 1,400 gpm for 5 years in each of the city's six existing wells was simulated with the model; the second stage of pumping plan 2 differed from stage 1 only in that five planned wells were added to the six existing wells. Model results of plan 2 indicate that water levels in the area of the well field would be lowered as much as 40 feet. Drawdown at two of the well sites would approach 60 ft, leaving less than 15 ft of the initial 70 ft of saturated thickness at the two wells after 10 years' pumping. (Woodard-USGS)  
W77-00482

**GROUND-WATER DATA FOR ATTALA COUNTY, MISSISSIPPI,**  
Geological Survey, Jackson, Miss.  
For primary bibliographic entry see Field 7C.  
W77-00484

**GROUND-WATER QUALITY IN THE DAVIE LANDFILL, BROWARD COUNTY, FLORIDA,**  
Geological Survey, Tallahassee, Fla.  
For primary bibliographic entry see Field 5B.  
W77-00486

**CHANGES IN THE WATER SUPPLY IN THE UPPER REPUBLICAN NATURAL RESOURCES DISTRICT, SOUTHWEST NEBRASKA, FROM 1952-75,**  
Geological Survey, Lincoln, Nebr.  
E. G. Lappala.  
Open-file report 76-498, July 1976. 17 p, 4 fig, 1 tab, 4 ref.

Descriptors: \*Groundwater resources, \*Irrigation effects, \*Drawdown, \*Water levels, \*Nebraska, Water supply, Water demand, Hydrologic data, Surface-groundwater relationships, Aquifer characteristics, Pumping, Groundwater recharge, \*Water districts.  
Identifiers: Southwest Nebraska, \*Upper Republican Natural Resources Dist(Neb).

Use of ground water for irrigation has increased rapidly in the Upper Republican Natural Resources District in southwestern Nebraska in recent years. The principal aquifer being developed is composed of saturated and gravel of the Ogallala Formation of Tertiary age. Water-level declines of as much as 16 feet (4.9 meters) have occurred. Base flow of major streams draining the aquifer was reduced by as much as 19 percent between 1967 and 1975. Recoverable ground water in storage was reduced by about 1 percent. New withdrawal of ground water in 1975 was about 250,000 acre-feet (308 million cubic meters), compared with estimated recharge from precipitation of 176,000 acre-feet (217 million cubic meters). Water levels and streamflow will continue to decline if ground-water withdrawals continue at or greater than the 1975. (Woodard-USGS)  
W77-00489

**ONE-DIMENSIONAL SIMULATION OF AQUIFER SYSTEM COMPACTION NEAR PIXLEY, CALIFORNIA: 2. STRESS-DEPENDENT PARAMETERS,**  
Geological Survey, Menlo Park, Calif.  
For primary bibliographic entry see Field 2F.  
W77-00490

**WATER QUALITY ASPECTS OF WELL RECHARGE WITH RECLAIMED WATER, BAY PARK, NEW YORK,**  
Geological Survey, Albany, N.Y.  
For primary bibliographic entry see Field 5D.  
W77-00492

### 4C. Effects On Water Of Man's Non-Water Activities

**URBAN WATERSHED MANAGEMENT USING ACTIVITY INDICATORS TO PREDICT WATER QUALITY,**  
Carnegie-Mellon Univ., Pittsburgh, Pa. Environmental Studies Inst.  
For primary bibliographic entry see Field 5A.  
W77-00106

**THE IMPACT OF MAN ON THE WORLD NITROGEN CYCLE,**  
Purdue Univ., Lafayette. Dept. of Agricultural Economics.  
For primary bibliographic entry see Field 5A.  
W77-00312

**EROSION AND RUNOFF ON FOREST AND RANGE LANDS,**  
Forest Service (USDA), Ogden, Utah. Intermountain Forest and Range Experiment Station.  
R. O. Meeuwig, and P. E. Packer.  
In: Proceedings of the Fifth Workshop of the United States/Australia Rangelands Panel, June 15-22, 1975, Boise, Idaho, Utah Water Research Laboratory, Utah State University, Logan, Utah,

## Watershed Protection—Group 4D

Report INT R-443, p 105-116, March, 1976. 3 fig, 73 ref.

Descriptors: \*Erosion, \*Runoff, \*Forest watersheds, \*Ranges, \*Lumbering, \*Road construction, \*Grazing, \*Mining, Recreation, Forest fires, Burning, Surface runoff, \*Range management, \*Forest management.  
Identifiers: \*Surface mining.

This report discusses logging, road construction, grazing, surface mining, and recreation as these major uses affect erosion and runoff on forest and range lands. Fire is also discussed because it greatly affects erosion and runoff. (Witt-IPC)  
W77-00332

**THE EFFECT OF HUMANS ON BIOGEOCENOSES AND ENVIRONMENTAL PROTECTION, (IN RUSSIAN),**  
For primary bibliographic entry see Field 6G.  
W77-00412

**FLOODFLOW CHARACTERISTICS AT PROPOSED BRIDGE SITE ON FISHKILL CREEK, FISHKILL, NEW YORK,**  
Geological Survey, Albany, N.Y.  
T. J. Zembrzski, Jr., and B. Dunn.  
Open-file report 76-595, August 1976. 8 p, 3 fig, 3 tab, 5 ref.

Descriptors: \*Flood flow, \*Bridge design, \*Backwater, \*Flood recurrence interval, \*Flood discharge, Engineering structures, Bridge construction, Hydrologic data, Evaluation, Planning, \*New York, Flood frequency, Flood profiles.  
Identifiers: \*Fishkill Creek (NY).

An evaluation of floodflow characteristics of Fishkill Creek at the proposed bridge site at Fishkill, N.Y., was made for the 50- and 100-year floods. The flood-frequency analysis revealed that the magnitude of the 50- and 100-year floods are 8,000 cubic feet per second (cfs) and 10,000 cfs, respectively. The normal water-surface elevation at the approach cross section was determined by the slope-conveyance method to be 209.8 feet during a 50-year flood and 210.8 feet during a 100-year flood. Also included is an analysis of the effect of the existing bridge and of two alternative bridge designs on the profiles of floods having recurrence intervals of 50 and 100 years. (Woodard-USGS)  
W77-00483

**AN OVERVIEW OF URBAN SEDIMENTOLOGY,**  
Geological Survey, Reston, Va.  
H. P. Guy.

In: National Symposium on Urban Rainfall and Runoff and Sediment Control: Proceedings of Symposium held July 29-31, 1974, Lexington, Kentucky. Report UKY BU106, Kentucky University, Office of Research and Engineering Services, p 149-159, October 1974. 8 fig, 15 ref.

Descriptors: \*Sediment transport, \*Urbanization, \*Storm runoff, \*Construction, \*Soil erosion, Channel erosion, Erosion control, Methodology, Urban hydrology, Sedimentology, Sediment yield, Runoff.

Urban sedimentology implies all theoretical, scientific, analytical, and philosophical studies of particulate matter moved, or likely to be moved, by water, wind, ice, gravity, or man in an existing or developing urban area. More commonly, however, urban sedimentology is concerned with (1) spatial and temporal erosion of soils in construction areas, (2) the nature of the movement and impact of sediments in construction areas and in water bodies downstream, (3) methods for mitigating erosion and sediment movement, and (4) channel erosion downstream where flows have increased as a result of increased imperviousness from urbanization. Minimizing sediment problems in an

urban development area begins with sound land use and structure design, then makes use of practical vegetative controls on as much of the site as possible, for as much time as possible to prevent erosion and trap sediment; and then makes use of physical controls to slow runoff and trap sediment. Such controls must be applied with specific criteria as to their needs and effectiveness; that is, the reduction in damages must exceed the cost of application. (See also W76-09729) (Woodard-USGS)  
W77-00491

## 4D. Watershed Protection

**ENGINEERING STUDY AND FIELD DEMONSTRATION TRIALS FOR SAND DUNE STABILIZATION,**  
Ward (George D.) and Associates, Portland, Oreg.  
For primary bibliographic entry see Field 5E.  
W77-00032

**MORPHOLOGY OF COBBLE STREAMS IN SMALL WATERSHEDS,**  
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.  
For primary bibliographic entry see Field 2E.  
W77-00089

**GUIDELINES FOR SEDIMENT CONTROL IN IRRIGATION RETURN FLOW,**  
Agricultural Research Service, Kimberly, Idaho.  
Snake River Conservation Research Center.  
For primary bibliographic entry see Field 5G.  
W77-00090

**GULLY DEVELOPMENT AND CONTROL: THE STATUS OF OUR KNOWLEDGE,**  
Forest Service (USDA), Tempe, Ariz. Rocky Mountain Forest and Range Experiment Station.  
For primary bibliographic entry see Field 2J.  
W77-00097

**TRI-STATE CONFERENCE REPORT: METHODS FOR BEACH AND SAND DUNE PROTECTION,**  
Georgia Dept. of Natural Resources, Atlanta.  
In: 'Methods for Beach and Sand Dune Protection', March 31-April 2, 1974, Jekyll Island, Ga. 48 p, 6 fig.

Descriptors: \*Erosion control, \*Shore protection, \*Beaches, \*Dunes, Sands, Georgia, North Carolina, South Carolina, Conferences, Barrier islands, Stability, Methodology, Seashores, Governmental interrelations, Vegetation, Barriers, Costs, Land use, Legislation, Social participation, Planning, \*Southeast US.

A conference of representatives from Georgia and North and South Carolina, discussed the importance of the natural beach and sand dune system; typical features of a Georgia barrier island; role of dunes in shoreline stability; energy of the tide and its effect on the coastal zone; critical areas in the shore zone of some Georgia islands; ecological consequences of barrier island migration and management in North Carolina; and coastal processes at Tybee Island, Georgia (an eroding barrier island); stabilizing of coastal dunes; beach erosion control in South Carolina; beach stabilization with experimental nylon bag groins; role of a local citizen commission in dune protection; inter-governmental cooperation for dune protection at Savannah Beach, Georgia; federal interest in beach and dune protection; role of citizens in sand dune protection; criteria for successful beach erosion control projects; and intergovernmental cooperation for beach and sand dune protection. It was pointed out that beaches and sand dunes are fragile systems requiring careful management and must be understood to be

controlled. Too often costs and benefits have not been measured before undertaking projects. Protection is the joint responsibility of local, state, and federal governments, in which citizens have an important role to play. (Buchanan-Davidson-Wisconsin).  
W77-00193

**CATCHMENT MODELING AND INITIAL PARAMETER ESTIMATION FOR THE NATIONAL WEATHER SERVICE RIVER FORECAST SYSTEM,**  
National Weather Service, Washington, D.C. Office of Hydrology.  
For primary bibliographic entry see Field 2A.  
W77-00272

**ECONOMIC IMPACTS OF STATE ENVIRONMENTAL PROGRAMS IN A NATIONAL FRAMEWORK: THE IOWA CONSERVANCY LAW,**  
Iowa State Univ., Ames. Center for Agricultural and Rural Development.  
For primary bibliographic entry see Field 6G.  
W77-00303

**EROSION AND RUNOFF ON FOREST AND RANGE LANDS,**  
Forest Service (USDA), Ogden, Utah. Intermountain Forest and Range Experiment Station.  
For primary bibliographic entry see Field 4C.  
W77-00332

**GEOMORPHOLOGICAL MAPPING APPLIED TO SOIL EROSION EVALUATION,**  
National Inst. of Agricultural Engineering, Silsoe (England).  
For primary bibliographic entry see Field 2J.  
W77-00369

**FACTORS AFFECTING SPRING RUNOFF ON TWO FORESTED WATERSHEDS,**  
Forest Service (USDA), Flagstaff, Ariz. Rocky Mountain Forest and Range Experiment Station.  
For primary bibliographic entry see Field 2E.  
W77-00374

**CHANNEL EROSION SURVEYS ALONG TAPS ROUTE, ALASKA, 1975,**  
Geological Survey, Anchorage, Alaska.  
For primary bibliographic entry see Field 2J.  
W77-00433

**IOWA'S EXPERIENCE WITH A MANDATORY SEDIMENT CONTROL LAW,**  
Iowa Dept. of Soil Conservation, Des Moines.  
For primary bibliographic entry see Field 6E.  
W77-00477

**SEDIMENT DISCHARGE IN THE UPPER ARROYO GRANDE AND SANTA RITA CREEK BASINS, SAN LUIS OBISPO COUNTY, CALIFORNIA,**  
Geological Survey, Menlo Park, Calif.  
For primary bibliographic entry see Field 2J.  
W77-00487

**AN OVERVIEW OF URBAN SEDIMENTOLOGY,**  
Geological Survey, Reston, Va.  
For primary bibliographic entry see Field 4C.  
W77-00491

**STUDY OF THE EROSION STABILITY OF THE FLOW LAYERS OF GRAY FOREST SOILS OF THE NORTHERN FOREST-STEPPE, (IN RUSSIAN),**  
Moscow State Univ. (USSR). Dept. of Soil Physics and Reclamation.



## Field 4—WATER QUANTITY MANAGEMENT AND CONTROL

### Group 4D—Watershed Protection

M. S. Kuznetsov, V. Ya. Grigor'ev, E. G. Aleksandrova, and G. P. Glazunov.  
Biol Nauki. 18(2), p 122-126, 1975.

Descriptors: \*Forest soils, Gray-Brow podzolic soils, \*Analytical techniques, Mathematical studies, \*Erosion, Slope stability, \*Erosion control, Grasslands.  
Identifiers: Steppes, USSR.

The erosion stability of the gray forest soils of the right-bank region of the Oka River, USSR, which are subjected to intense processes of slope erosion was evaluated by means of the values of the permissible (noneroding) water-flow velocities, i.e., the flow velocities at the height of the projections of the channel bed not causing erosion. An equation is derived for calculating the permissible flow velocities. The data obtained can be used for forecasting slope erosion and for developing anti-erosion measures.—Copyright 1975, Biological Abstracts, Inc.  
W77-00514

## 5. WATER QUALITY MANAGEMENT AND PROTECTION

### 5A. Identification Of Pollutants

**CHARACTERISTICS OF RURAL HOUSEHOLD WASTEWATER.**  
Wisconsin Univ., Madison. Small Scale Waste Management Project.  
R. Siegrist, M. Witt, and W. C. Boyle.  
Journal of the Environmental Engineering Division-ASCE, Vol. 102, No. EE3, p 533-548, June, 1976. 3 fig, 17 tab, 15 ref.

Descriptors: \*Domestic water, \*Domestic wastes, \*On-site investigations, Water requirements, Biochemical oxygen demand, Suspended solids, Nitrogen compounds, Phosphorus compounds, Microorganisms, Disinfection, Water reuse, \*Pollutant identification.

Water use was monitored at 11 rural homes for about a month and waste water quality was monitored at three of the residences. Water usage yielded an average flow of 42.6 gallons/capita/day. Laundry, bath/shower, toilet flushings, dishwashing, water softener use, and other events accounted for the following percentages of water use: 24.7%, 23.5%, 21.5%, 11.4%, 6.2%, and 12.7%, respectively. The average daily contributions of biochemical oxygen demand, suspended solids, total nitrogen, and total phosphorus were 0.109, 0.77, 0.013, and 0.009 pounds of pollutant/capita/day, respectively. Bacteriological analyses indicated wide variation in indicator organisms and the possibility of pathogenic organisms in bath and laundry waste waters. Therefore, disinfection of these prior to reuse is recommended. (Kreager-FIRL)  
W76-00048

**PROCEEDINGS OF THE 1975 NATIONAL CONFERENCE ON MUNICIPAL SLUDGE MANAGEMENT AND DISPOSAL.**  
Environmental Protection Agency, Washington, D.C. Office of Research and Development.  
For primary bibliographic entry see Field 5D.  
W77-00009

**ENVIRONMENTAL EFFECTS OF SLUDGE DISPOSAL IN SANITARY LANDFILLS.**  
Environmental Protection Agency, Washington, D.C.  
For primary bibliographic entry see Field 5C.  
W77-00030

**BIOASSAY PROCEDURES FOR THE OCEAN DISPOSAL PERMIT PROGRAM.**  
Environmental Protection Agency, Gulf Breeze, Fla. Environmental Research Lab.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-253 209, Price codes: A06 in paper copy, A01 in microfiche. Report EPA-600/9-76-010, May, 1976. 106 p, 9 fig, 12 tab, 87 ref.

Descriptors: \*Pollutant identification, \*Analytical techniques, \*Bioassay, \*Oysters, \*Algae, Marine fish, Crustaceans, Brine shrimp, Waste disposal, Toxicity.  
Identifiers: \*Ocean Disposal Permit Program(EPA).

Bioassay procedures are given which were developed to provide tests for conducting toxicity evaluations of waste materials considered for ocean disposal under the Environmental Protection Agency's (EPA) Ocean Disposal Permit Program. Three of the nine bioassay procedures described, the oyster shell growth procedure, the chronic fish egg-to-egg procedure, and the acetylcholinesterase inhibition test, are not recommended for routine use. At least three species from different taxonomic groups and representing several trophic levels should be used in evaluating a dumping permit. The procedures include both flow-through and static tests. The methods vary in their utility and complexity of performance. The procedures are not intended to be 'standard methods' but as guides for those involved in evaluating ocean dumping permits. (Snyder-FIRL)  
W77-00041

**TRACE ORGANIC COMPONENTS AS FINGERPRINTS IN GAS CHROMATOGRAPHIC IDENTIFICATION OF SPILLED ASPHALTS.**  
Environmental Monitoring and Support Lab., Cincinnati, Ohio.  
F. K. Kawahara.  
Environmental Science and Technology, Vol. 10, No. 8, p 761-765, August 1976. 8 fig, 3 tab, 15 ref.

Descriptors: \*Water pollution, \*Pollutant identification, \*Asphalt, \*Gas chromatography, Organic compounds, Spectroscopy, Pollutants, Pollution, Path of pollution, Path of pollutants, Pollution sources, Rivers, Chemistry, Chemical analysis, Tracers.  
Identifiers: Pentafluorobenzyl derivatives.

The development and testing of a new concept for oil identification this past year made possible the successful application of gas chromatography to the analysis and identification of asphalts. Through the use of electron capture detection-gas chromatography, the passively labeled pentafluorobenzyl thioethers and ethers which are derivatives of weak acids present in trace amounts in discharged heavier petroleum products were separated, and the resulting chromatograms served as fingerprints for identification. (Sims-ISWS)  
W77-00085

**ASSOCIATIONS OF CHLORINATED HYDROCARBONS WITH FINE PARTICLES AND HUMIC SUBSTANCES IN NEARSHORE SURFICIAL SEDIMENTS.**  
University of Southern California, Los Angeles. Environmental Engineering Program.  
W. W. Choi, and K. Y. Chen.  
Environmental Science and Technology, Vol. 10, No. 8, p 782-786, August 1976. 6 fig, 4 tab, 34 ref.  
Army DACW39-74-C-0077.

Descriptors: \*Chlorinated hydrocarbon pesticides, \*Sediments, \*Pollutant identification, Sampling, Laboratory tests, Pesticides, Organic pesticides, Organic compounds, DDE, DDD, DDT, Polychlorinated biphenyls, Aroclors, Particle size, Humus, Fulvic acids, Pollutants, Water pollution, Harbors, Sewage effluents, Outfall sewers.

Sediment samples from Los Angeles Harbor along the Terminal Island sewer outfall to the breakwater entrance were collected. Upon extrusion from cores, these sediment samples were sealed in plastic bags and stored in ice at 4°C for transport to the laboratory, where the well-mixed subsamples were transferred into an airtight plastic container in a glove bag under a nitrogen atmosphere. The samples were stored in a refrigeration unit at approximately 4°C until used. The homogenized sediment from each station was split into three fractions to be extracted and/or analyzed for humic and fulvic acids, chlorinated hydrocarbons, and particle size. It was found that: p,p'-DDE generally accounts for 60-70% of the total chlorinated hydrocarbon content in sediment, whereas PCB's (mostly Aroclor 1254) constitute almost 10-20% of the total. Other isomers of DDT and dieldrin account for the remaining fraction. Concentrations of chlorinated hydrocarbons are closely related to the organic contents and to particles of 8 micrometers or less in size. Total organic carbons of sediments as well as fulvic and humic acid fractions bear a linear relationship with respect to concentrations of chlorinated hydrocarbons in sediments. Total chlorinated hydrocarbon contents of sediments studied range from 0.3 to 3.5 ppm, whereas total organic carbon contents range from 0.45 to 1.70% on a dry weight basis. (Sims-ISWS)  
W77-00086

**RESPIROMETRIC DETERMINATION OF BOD.**  
Birmingham Univ., (England). Dept. of Civil Engineering.  
T. H. Y. Tebbutt, and M. Berkun.  
Water Research, Vol. 10, No. 7, p 613-617, 1976. 5 fig, 3 tab, 11 ref.

Descriptors: \*Pollutant identification, \*Biochemical oxygen demand, \*Organic matter, \*Instrumentation, \*Oxygen demand, Oxygen, Water properties, Dissolved oxygen, Eutrophication, Water pollution, Water quality, Chemistry, Analytical techniques, Chemical analysis, Organic wastes, Properties, Dissolved oxygen analyzers, Graphical analysis, Mathematical models.  
Identifiers: \*Respirometers, Gilson respirometers, Warburg respirometers, Large volume respirometers.

Oxygen uptake data obtained from a simple large volume respirometer have shown good correlation with conventional BOD data. The effect of carbon dioxide deficiency was found to be of some significance in respirometric work. (Henley-ISWS)  
W77-00095

**URBAN WATERSHED MANAGEMENT USING ACTIVITY INDICATORS TO PREDICT WATER QUALITY.**  
Carnegie-Mellon Univ., Pittsburgh, Pa. Environmental Studies Inst.  
W. P. Darby, F. C. McMichael, and R. W. Dunlap.  
Water Resources Research, Vol. 12, No. 2, p 245-252, April 1976. 1 fig, 18 ref, 6 tab.

Descriptors: \*Water quality, \*Water quality control, \*Water management (Applied), \*Watersheds (Basins), \*Indicators, Land use, Urbanization, Waste disposal, Cities, \*Pollutant identification.  
Identifiers: Federal Water Pollution Control Act of 1972, Discriminant analysis technique, Activity indicators, Stream potential.

The 1972 Federal Water Pollution Control Act amendments (public law 92-500) established water quality goals and proposed methodology appropriate for major rivers. The role of small urban watersheds which drain into a small stream which eventually joins a large urban river was studied using fifty-two small watersheds in Allegheny County (PA). Three data bases were sought: stream sampling data, perceived water quality data and watershed data. Stream sampling data included pH, dissolved oxygen, total coliform, total

dissolved solids, total iron and temperature. Experts were asked to analyze water quality by perception, rating streams on a scale of 1 to 5 from poor to excellent quality. Sixteen indicators were used to predict actual stream quality for watersheds for which no direct stream quality measures exist. The 16 indicators were subdivisions of 7 principal activities, including municipal waste disposal, solid waste disposal, urbanization, acid mine drainage, industrial waste disposal, siltation and stream potential. The discriminant analysis technique was employed to relate activity indicators to actual water quality. The concept of activity indicators is valuable when data are sparse, disaggregate or discontinuous in nature, or when an agency does not have the funds for extensive monitoring programs. With limited sampling data, indicators of watershed characteristics may be used to estimate overall water quality of a stream and predict individual problem parameters. Local authorities may therefore participate more fully in management of small urban watersheds. (Gentry-North Carolina)  
W77-00106

**BIOLOGICAL ASSESSMENT OF WATER QUALITY IN THREE BRITISH RIVERS: THE NORTH ESK (SCOTLAND), THE IVEL (ENGLAND) AND THE TAF (WALES).**  
Aston Univ., Birmingham (England). Dept. of Biological Sciences.  
D. Balloch, C. E. Davies, and F. H. Jones.  
Water Pollution Control, Vol. 75, No. 1, 1976. p 92-114. 9 fig, 18 ref.

Descriptors: Indexing, Documentation, \*Data processing, \*Water quality, \*Benthic communities, Methodology, Testing procedures, Habitats, Sampling, Effluent, Bioassay, \*Pollutant identification.  
Identifiers: \*Trent biotic index, \*Chandler's score system, \*Kotze's species deficit, \*Graham's biotic index, \*Community diversity index, \*Benthic macro-invertebrates, North Esk River(Scotland), Ivel River(England), Taf River(Wales), Riffle habitat.

Data processing methods are compared and evaluated. Individual biological surveys were carried out on 3 British rivers: North Esk, Ivel and Taf. Benthic communities were used as an index or summary indicator reflecting ecological conditions caused by effluent discharge. Parameters varied between rivers, but included: temperature, pH, specific conductance, dissolved oxygen (DO), biological oxygen demand (BOD), nitrite, nitrate, total hardness, alkalinity, chloride, phosphate, sulphate, velocity of water flow and nature of substrate, among others. Benthic macro-invertebrates were chosen as most suitable organisms for assessing water quality. The riffle habitat was chosen for collection of samples because of the large number of microhabitats and presence of most macro-invertebrate species sensitive to water quality deterioration. Two sampling techniques were used: the heel-kick and stop net method, and a cylindrical core sampler (modification of the Neill design) to test the substratum. Data were collected into several numerical indexes and then compared to assess their value as criteria of water quality. The indexes were: the Trent biotic index, Graham's biotic index, the Community diversity index, Chandler's score system and Kotze's species deficit. The physical-chemical results in all 3 rivers were that sewage effluent produced elevated concentrations of nitrate, nitrite, ammonia, synthetic detergents, SS, BOD and reduced DO concentrations. The biological analysis compared sensitivity to changes in water quality, effect of sampling habitat and other factors concluding that the Chandler's score system was most appropriate as a water quality index. (Gentry-North Carolina)  
W77-00108

**OPTIMIZATION OF STATE WATER QUALITY MONITORING SYSTEMS.**  
Environmental Research Lab., Corvallis, Oreg.  
For primary bibliographic entry see Field 5G.  
W77-00120

**A PHOSPHORUS RESIDENCE TIME MODEL: THEORY AND APPLICATION.**  
Texas Univ. at Dallas, Richardson. Inst. for Environmental Sciences.  
For primary bibliographic entry see Field 5B.  
W77-00124

**CARCINOGENIC NITROSAMINES AND THEIR PRECURSORS IN FRESH AND POLLUTED WATERS.**  
Cornell Univ. Agricultural Experiment Station, Ithaca, N.Y. Dept. of Agronomy.  
M. Alexander.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-258 778, Price codes: A03 in paper copy, A01 in microfiche. Completion Report, September 1976. 24 p, 15 tab. OWR T A-055-NY(1). 14-31-0001-5032, 14-34-0001-6033.

Descriptors: \*Pollutant identification, Methodology, Analytical techniques, \*Gas chromatography, Separation techniques.  
Identifiers: \*Nitrosamines, Dialkyl nitrosamines, Carcinogens, Nitroso compounds, \*Amines.

A series of methods was developed and tested for the analysis of nitrosamines that might be present in natural water. Initially, the recovery of added nitrosamine in distilled water was quite poor. In sewage amended with nitrosamines, recovery of dimethyl and diethylnitrosamines was low although recovery of two other nitrosamines was greater than 75%. Using an Amberlite resin, the recovery of nitrosamines added to lake water ranged from 24 to 53% for diethylnitrosamine and from 65 to 97% for other nitrosamines. Recoveries of diethylnitrosamine with Amberlite were higher when this carcinogen was added to sewage. However, when nitrosamines in water were trapped on activated carbon, the nitrosamine recovery ranged from 89 to 116%, regardless of the nitrosamine tested. Recovery of these compounds by steam distillation was not as high. A method was finally devised which permitted recovery of nitrosamines from water containing parts per billion levels. In these investigations, gas chromatographic techniques were employed for detection.  
W77-00146

**REMOTE DETECTION OF WATER POLLUTANTS BY COMPUTERIZED LASER-RAMAN SPECTROSCOPY.**  
Rhode Island Univ., Kingston. Dept. of Chemistry.  
C. W. Brown.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-258 777, Price codes: A03 in paper copy, A01 in microfiche. Completion Report, (1976). 29 p, 10 fig, 3 tab, 7 ref. OWR T A-054-RI(1).

Descriptors: \*Pollutant identification, \*Spectroscopy, Water pollution, Chemicals, \*Remote sensing, Data processing.  
Identifiers: \*Laser raman spectroscopy, \*Hazardous chemicals.

Hazardous chemicals in water have been analyzed remotely and by conventional instrumentation using a digitized Raman spectrometer. Several data processing methods were explored in order to lower the level of detectability. Furthermore, the feasibility of using the resonance Raman effect to lower the level of detectability was investigated. It is possible to detect many hazardous chemicals in the 1-10 ppm range using either data processing or the resonance Raman effect.  
W77-00154

**ASSESSMENT OF PRACTICALITY OF REMOTE SENSING TECHNIQUES FOR A STUDY OF THE EFFECTS OF STRIP MINING IN ALABAMA.**  
Alabama Univ., University. Dept. of Geology and Geography.  
For primary bibliographic entry see Field 5C.  
W77-00170

**ISOLATION AND IDENTIFICATION OF BLUE-GREEN ALGAE PRODUCING MUDDY ODOR METABOLITES, GEOSMIN, AND 2-METHYLISSOBORNEOL, IN SALINE LAKES IN MANITOBA.**  
Fisheries and Marine Service, Winnipeg (Manitoba). Freshwater Inst.  
J. L. Tabachek, and M. Yurkowski.  
Journal of the Fisheries Research Board of Canada, Vol. 33, No. 1, p. 25-35, 1976. 7 fig., 1 tab., 56 ref.

Descriptors: \*Odor-producing algae, \*Cyanophyta, \*Saline lakes, Water pollution sources, \*Canada, Fish, \*Pollutant identification.  
Identifiers: \*Geosmin, Methylisoborneol, Manitoba(Canada), Oscillatoria, Lyngbya, Symplocos muscorum, Muddy odor, Lacquer odor.

Rainbow trout farmed in the saline lakes of southwestern Manitoba developed a muddy flavor which was attributed to geosmin and/or 2-methylisoborneol produced by blue-green algae. The algae producing geosmin were *Oscillatoria* cf. *prolifera*, *O. tenuis*, *O. cf. cortiana*, *O. cf. variabilis*, *O. agardhii*, *O. splendida*, *O. sp.* *Symplocos* cf. *muscorum*, *Lyngbya* cf. *aestuarii*, and *L. sp.* *Lyngbya* cf. *cryptovaginata*, the latter the first alga reported to produce 2-methylisoborneol, an odor resembling lacquer. Actinomycetes or other bacteria were not detected in these lakes. It was found that *O. splendida*, *O. prolifica*, *O. cortiana*, and *Lyngbya aestuarii* produced the most geosmin—approximately four times more than *O. tenuis* and *Symplocos muscorum*, 20 times more than *O. agardhii*, and 50 times more than *O. variabilis*. Identical growth, extraction, and gas chromatographic analytical conditions were used. The algae that produce geosmin may grow throughout all of part of the year; certain *Oscillatoria* and *Lyngbya* species tend to occur in higher numbers or even become dominant in polluted, high organic content, or fertilized water. Previous reports of planktonic blooms of *O. prolifica* and *O. agardhii* have shown to produce geosmin. Sediment blooms of *O. limosa*, *O. princeps*, *O. splendida*, and *O. tenuis* have also been reported as odor producers. (Auen-Wisconsin).  
W77-00185

**DEPOSITION OF AIRBORNE MERCURY FROM SIX SWEDISH CHLOR-ALKALI PLANTS SURVEYED BY MOSS ANALYSIS.**  
Swedish Water and Air Pollution Research Lab., Goteborg.  
T. Wallin.  
Environmental Pollution, Vol. 10, p. 101-114, 1976. 8 fig., 2 tab., 11 ref.

Descriptors: \*Mercury, \*Air pollution, \*Industrial wastes, \*Analytical techniques, \*Mosses, Fallout, Spatial distribution, Europe, \*Pollutant identification, Path of pollutants.  
Identifiers: \*Sweden, Hypnum cupressiforme, Chlor-alkali industry.

Local contamination by airborne mercury from six Swedish chlor-alkali plants was studied by analyzing mercury accumulated in moss. Samples of the carpet-forming moss, *Hypnum cupressiforme*, were collected from a 15 km radius around each plant and the dry moss mercury contents were measured by neutron activation analysis. The highest mercury levels were found near the plants. As distance from the plants increased. Between 9-15 km from the plants, the background mercury level of the area was reached. Annual fall-out esti-

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5A—Identification Of Pollutants

mates indicated that only a minor part of emitted mercury was deposited locally. The mercury was spread over very large areas and probably contributed to global circulation and regional background deposition. These results confirmed those obtained by the snow-sampling method. The moss-sampling method indicated that a larger area was affected by mercury deposition and that local fall-out was a larger fraction of the total emission volume, perhaps due to seasonal variations in mercury transport and fluctuations in emission due to temperature. Moss analysis can be used to survey local mercury contamination from the atmosphere, but the method needs improvement. (Buchanan-Davidson-Wisconsin)  
W77-00186

**ALGAL PRODUCTIVITY IN 49 LAKE WATERS AS DETERMINED BY ALGAL ASSAYS,**  
Pacific Northwest Environmental Research Lab., Corvallis, Oreg.  
For primary bibliographic entry see Field 5C.  
W77-00187

**THE EXTRA 02 EVOLVED DURING NITRATE UTILIZATION BY CHLORELLA,**  
Centre d'Etudes Nucleaires de Cadarache, Saint Paul-lez-Durance (France). Department de Biologie.  
For primary bibliographic entry see Field 5C.  
W77-00191

**LOS ANGELES HARBOR FIELD INVESTIGATION OF OIL AND BACKGROUND LUMINESCENCE SIGNATURES,**  
McDonnell Douglas Astronautics Co., Huntington Beach, Calif.  
H. G. Gross.  
Available from the National Technical Information Service, Springfield, VA 22161 as AD/A-016 466. Price codes: A06 in paper copy, A01 in microfiche. U.S. Coast Guard Final Report No. USCG-D-154-75, May 1975. 118 p., 42 fig., 11 tab., 17 ref. DOT-CG-51998-A.

Descriptors: \*Oil pollution, \*Water pollution sources, \*Aromatic compounds, \*Remote sensing, \*Resources development, California, Harbors, Continental Shelf, Gas chromatography, Mass spectrometry, Reflectance, Ultraviolet radiation, Pollutant identification.  
Identifiers: \*Outer Continental Shelf, Grease, Luminescence, Sky scattered daylight, Signatures, Lasers.

The USCG Program was intended to provide a first look at the possible background signatures, their relevance to site water constituents, and their possible interference with oil signatures when using a remote sensing laser fluorosensor system in an actual harbor. Specifically, the USCG Program was to obtain, by remote sensing from a ground based laser fluorosensor system, laser induced luminescence signatures of the seawater at the one channel and five harbor sites. The signatures are similar, indicating dominance by one or more common constituents. The peak at about 4500 Å and shape of the signature suggest dominance by heavier aromatics, probably by oil and grease, among the principal pollutants. Gas chromatograph-mass spectrometer analyses of site samples show light and heavy constituents, some of which are aromatics. Luminescence signatures of light, medium and heavy oils were established as measurable against the strong water luminescence background. Reflectance signatures of oil films on water indicate a luminescent component due to sky scattered daylight and direct sun UV irradiation. Multispectral photography provided a few examples of site supportive information. (Sinha-OEIS)  
W77-00197

**THE USE OF ERTS-1 TO MORE FULLY UTILIZE AND APPLY MARINE STATION DATA TO THE STUDY AND PRODUCTIVITY ALONG THE EASTERN SHELF WATERS OF THE UNITED STATES,**  
Old Dominion Univ. Research Foundation, Norfolk, Va.  
H. G. Marshall, D. E. Bowker, and W. G. Witte.  
Available from the National Technical Information Service, Springfield, VA 22161 as N-76-18588. Price codes: A03 in paper copy, A01 in microfiche. Old Dominion University Research Foundation Final Report prepared for Goddard Space Flight Center, February 1976. 49 p., 10 fig., 15 tab., 6 ref. NAS5-21816.

Descriptors: \*Chlorophyll, \*Phytoplankton, \*Remote sensing, \*Sediments, \*Suspended solids, \*Oceanographic data, \*Monitoring, \*Productivity, Continental Shelf, Satellites (Artificial), Temperature, Salinity.  
Identifiers: \*Outer Continental Shelf, \*Sea truth data, \*Pelagic areas, U.S. East Coast, Chesapeake Bay, Radiance, Nearshore waters, Western North Atlantic Ocean, ERTS-1.

Sea truth data was obtained during two ERTS overpasses in waters near the entrance of the Chesapeake Bay. Correlations were made between total phytoplankton and chlorophyll values in these waters to radiance detected by ERTS in an effort to map areas of similar productivity levels. Band 4 radiance had the highest correlation to all parameters with bands 5 and 6 showing decreasing correlations in each case. The radiance values were apparently influenced by one or more factors, most likely including the sediment content of the water. The data have shown that ERTS MSS is not suitable for monitoring chlorophyll in nearshore waters where sediment loads are high. It is suggested that in more seaward or pelagic locations, that ERTS MSS would be more efficient in monitoring surface chlorophyll values and establishing direct relationships to phytoplankton concentrations. (Sinha-OEIS)  
W77-00198

**TAGGING OIL-RESIDUES IN TANKERS WITH MICROPARTICLES,**  
Swedish Investigation Committee for Methods of Tagging Oil in Ships, Stockholm.  
P. O. Agneda.  
In: Prevention and Control of Oil Spills, Proceedings of Joint Conference, Washington, DC, March 13-15, 1973. p. 87-90, 1 tab., 1 ref.

Descriptors: \*Monitoring, \*Oil pollution, \*Oil spills, \*Pollution abatement, Tagging, Transportation, Water quality control, \*Pollutant identification.  
Identifiers: \*Detection, Tankers, Residues, Microparticles, Sweden, Baltic Sea.

The increase in pollution by oil spills in the Baltic has led to the Minister of Transport to set up a committee with the task to find methods for identifying ships responsible for oil spills. A preliminary study of the oil transport situation in Sweden has shown that the fingerprint method for identification will be difficult to use. The study also showed that microparticles of plastic and metal as tags might be used. In most cases the oil spills in the Baltic are due to pumping out residues mixed with ballast. In this paper the merits of different methods for tagging these residues, including the cost aspect, are treated as well as identification of recovered oil samples. In a field experiment the oil residues in a tanker were tagged. Some of its tanks were tagged with plastic particles and some with metal particles. The tanks were treated in different ways for cleaning and the oil-water mixtures were then pumped out in the sea under controlled conditions. The different spills were kept inside an enclosure for a fortnight and samples were taken every day. In all analysed samples the tagged substance could be recovered and identified. (See also W76-09312) (Sinha-OEIS)  
W77-00211

**THE DEVELOPMENT OF AN EXPERIMENTAL AIRBORNE LASER OIL SPILL REMOTE SENSING SYSTEM,**  
Transportation Systems Center, Cambridge, Mass.  
J. F. Fantasia, and H. C. Ingrao.  
In: Prevention and Control of Oil Spills, Proceedings of Joint Conference, Washington, DC, March 13-15, 1973. p. 101-115, 19 fig., 1 tab., 17 ref. append.

Descriptors: \*Remote sensing, \*Oil spills, \*Oil pollution, \*Pollution abatement, Water pollution, Fluorescence, Laboratory tests, Optics, Sea water, Equipment, Instrumentation, Monitoring, Resources, Pollutant identification.  
Identifiers: \*Outer Continental Shelf, Airborne lasers.

An experimental airborne laser oil spill remote sensing system has been developed. Operating from a U.S. Coast Guard Search and Rescue Aircraft, the system is expected to have the capability of remote detection, coarse oil classification (heavy, medium and light weight) and under certain conditions quantification of oil spills in the marine environment. The system concept is based on a recent investigation at TSC of laser stimulated oil fluorescence as a technique for the remote sensing of oil spills, including laboratory and field measurements. The development and laboratory tests results of the experimental system are described. (See also W76-09312) (Sinha-OEIS)  
W77-00213

**VOLUMETRIC DETERMINATION OF MARINE OIL SPILLS USING COORDINATED AIRBORNE AND SURFACE SAMPLING DATA,**  
California Univ. Santa Barbara.  
J. E. Estes, P. G. Mikolaj, R. R. Thaman, and L. W. Senger.  
In: Prevention and Control of Oil Spills, Proceedings of Joint Conference, Washington, DC, March 13-15, 1973. p. 117-125, 9 fig., 3 tab., 3 ref. DOT-CG-23260-A; SG-2-35208.

Descriptors: \*Oil pollution, \*Oil spills, \*Water pollution, \*Remote sensing, \*Pollution abatement, \*Volumetric analysis, Sampling, Films, Monitoring, Sampling.  
Identifiers: \*Outer Continental Shelf, Airborne measurement, Ground truth.

The detection, measurement, and monitoring of oil pollution in the marine environment are receiving increased attention owing to: (1) the growing incidence of oil spills; (2) the associated need for improved cleanup procedures; and (3) the need for more effective surveillance systems, capable of gathering legal evidence for the prosecution of violators. The Geography Remote Sensing Unit and the Department of Chemical and Nuclear Engineering at the University of California, Santa Barbara for 2 1/2 years has been conducting experiments related to the application of remotely sensed data to these problem areas. As part of a United States Coast Guard test of a high seas oil containment device, a system for estimating the volume of oil loss resulting from oil pollution incidents was developed. This system involved the coordination of remote sensing data acquisition with simultaneous collection of surface sampling data. Results indicate that remotely sensed data, when effectively correlated with surface sampling data, can provide a base for volumetric estimations of a given oil slick. Refinements of these techniques can lead to more efficient, real-time day/night, operational monitoring of marine oil pollution incidents. (See also W76-09312) (Sinha-OEIS)  
W77-00214

**DEVELOPMENT OF U.S. COAST GUARD PROTOTYPE AIRBORNE OIL SURVEILLANCE SYSTEM,**  
Coast Guard, Washington, D. C.; and Aerojet ElectroSystems Co. Azusa, Calif.



R. J. Ketchel, and A. T. Edgerton.

In: Prevention and Control of Oil Spills, Proceedings of Joint Conference, Washington, DC, March 13-15, 1973. p 127-137, 5 fig, 4 tab, 7 ref.

Descriptors: \*Oil spills, \*Oil pollution, Water pollution, Sea water, \*Monitoring, \*Remote sensing, Mapping, Equipment, \*Pollutant identification. Identifiers: \*Outer Continental Shelf, Detection, Surveillance, Airborne equipment, Sensors, Multispectral sensors, Microwave radiometric imager.

The U.S. Coast Guard has contracted with the Aerojet ElectroSystems Company, a Division of Aerojet-General Corporation, for the design, development and flight test evaluation of a prototype Airborne Oil Surveillance System. This system as conceived will utilize multispectral sensors to provide for the day/night all-weather airborne detection, mapping and documentation of oil spills at sea. The sensors used in this system will operate from the ultraviolet to the microwave region of the electromagnetic spectrum. This paper describes the development of this Airborne Surveillance System including the sensor mix and their relationship to the oil pollution surveillance mission. In addition the operational mission and system performance requirements used to define the system is considered. This prototype system will be ready for flight test evaluation by early 1974. (See also W76-09312) (Sinha-OEIS) W77-00215

#### REMOTE SAMPLER FOR DETERMINING RESIDUAL OIL CONTENT OF SURFACE WATERS,

Naval Ship Research and Development Center, Annapolis, MD.

P. Schatzberg, and D. F. Jackson. In: Prevention and Control of Oil Spills, Proceedings of Joint Conference, Washington, DC, March 13-15, 1973. p 139-144, 3 fig, 6 tab, 2 ref.

Descriptors: \*Surface waters, \*Oil spills, \*Oil pollution, Water pollution, \*Water pollution sources, \*Water quality control, Monitoring, \*Sampling, Coasts, Estuaries. Identifiers: \*Outer Continental Shelf, Residual oil, Sorbent.

A simple flow-through device has been developed which, in conjunction with a skimmer and pump, can process 100 to 200 liters or more of surface water, removing any oil present in a separate phase. Thus concentrated, the oil can be extracted at a laboratory, its quantity and nature determined, and when related to the volume of water processed through the sampler, provide oil concentration data on a time-integrated basis. A laboratory apparatus was designed to generate a flowing water stream containing parts per million (ppm) quantities of oil. A number of sorbent materials were examined with this apparatus and several were found effective. Effort was concentrated on the most promising one. Experiments showed that 5-25 ppm oil in a flowing water stream is quantitatively absorbed by the sorbent. The concentrated oil is easily removed from the sorbent with carbon tetrachloride used as solvent and a Soxhlet extractor. The sorbent is regenerated by this process and can be reused many times. Concentration of the extracted oil is determined by infrared spectrophotometry. (See also W76-09312) (Sinha-OEIS) W77-00216

#### AN OPTIMAL PREVENTION AND DETECTION MODEL FOR POLLUTION PATROL,

Purdue Univ., Lafayette, Ind. School of Industrial Engineering.

D. G. Olson, and G. P. Wright. In: Prevention and Control of Oil Spills, Proceedings of Joint Conference, Washington, DC, March 13-15, 1973. p 145-150, 3 fig, 2 tab, 2 ref. DOT-CG-23308-A.

Descriptors: \*Oil spills, \*Oil pollution, \*Water pollution, \*Pollution abatement, Model studies, Equipment, Monitoring, Pollutant identification. Identifiers: \*Outer Continental Shelf, Detection, Surveillance, Sensors, Hazardous materials.

A flight scheduling model is presented for sensor (infra-red and ultra-violet) equipped aircraft whose mission is the detection and prevention of harbor and coastal oil and hazardous material pollution. The objective of the model is to maximize the expected number of pollution incidents detected per pollution flight. The model requires, as an input, parameters representing probabilities of pollution incidents occurring for different geographical sectors. These parameters are estimated using, coastwise and harbor, petroleum and hazardous material shipping statistics. The shipping statistics considered include movement of petroleum products along the Atlantic, Pacific, and Gulf coasts as well as the movement of such commodities in the intra-coastal waterway system and the Great Lakes. Particular port characteristics and past pollution incident statistics are also used to estimate required parameters of the scheduling model. The constraints in the model concern the availability of aircraft, flight hours, mission hours, and the significant environmental factors which affect the performance of the sensors. (See also W76-09312) (Sinha-OEIS) W77-00217

#### OIL SPILL-SOURCE CORRELATION BY GAS CHROMATOGRAPHY: AN EXPERIMENTAL EVALUATION OF SYSTEM PERFORMANCE,

Woods Hole Oceanographic Institution, Mass.

O. C. Zafiriou, J. Myers, R. Bourbonniere, and F. J. Freestone. In: Prevention and Control of Oil Spills, Proceedings of Joint Conference, Washington, DC, March 13-15, 1973. p 153-159, 3 fig, 5 tab, 5 ref. Also as: Woods Hole Oceanographic Institution Contribution No. 2994. EPA-18050 HEC.

Descriptors: \*Oil spills, \*Oil pollution, \*Water pollution sources, \*Pollutant identification, Gas chromatography, New York, Maine. Identifiers: \*Outer Continental Shelf, New York Bight, Performance evaluation, Detection.

A simple gas chromatographic method correlates unknown oils in natural waters with possible source oils. Under the operating procedures involved, unique matches are generally achieved without miscorrelations, even when up to 15 oils of the same type are possible sources. Oil samples are quantitatively characterized by ratios of intensities corresponding to their contents of several components of known geochemical variability and resistance to weathering. The effects of weathering, sample types, and added spill control chemicals were determined by 'blind' correlation of 35 artificially weathered oils, each with one of 17 possible sources. Oil type and weathering did not seriously influence spill-source matching success. The presence of highly similar source oils was the major performance-limiting factor. (See also W76-09312) (Sinha-OEIS) W77-00218

#### TECHNIQUES FOR ANALYSIS OF PARAFFIN HYDROCARBONS AND FOR INTERPRETATION OF DATA TO ASSESS OIL SPILL EFFECTS IN AQUATIC ORGANISMS,

National Marine Fisheries Service, Seattle, Wash. Northwest Fisheries Center.

R. C. Clark, Jr., and J. S. Finley. In: Prevention and Control of Oil Spills, Proceedings of Joint Conference, Washington, DC, March 13-15, 1973. p 161-172, 4 fig, 5 tab, 15 ref.

Descriptors: \*Oil spills, \*Oil pollution, \*Water pollution sources, \*Environmental effects, \*Water pollution effects, Gas chromatography, Algae, Mussels, Crabs, Snails, Oysters, Aquatic animals, Aquatic environment.

Identifiers: \*Outer Continental Shelf, Paraffin hydrocarbons, Crude oil petroleum, Barnacles.

Normal paraffin hydrocarbons are one of the major groups of compounds in crude oil and petroleum products. Since these compounds can be readily separated from aquatic organisms using solvent extraction and liquid-solid chromatography and identified by gas-liquid chromatography, the normal paraffins can serve as indicators of petroleum pollution in the aquatic environment. It is necessary, however, to differentiate between natural (or biogenic) hydrocarbons and those assimilated by the organisms from pollution sources by comparing the natural hydrocarbon content and pattern of organisms from areas of pollution with those of organisms from relatively 'unpolluted' areas. The paper suggests techniques for obtaining and analyzing petroleum hydrocarbon data which can lead to a standard method for detecting and following the biological uptake of oil by living organisms from the aquatic environment. (See also W76-09312) (Sinha-OEIS) W77-00219

#### DETERMINATION OF N-ALKANE AND METHYLNAPHTHALENE COMPOUNDS IN SHELLFISH,

Battelle-Pacific Northwest Labs., Richland, Wash.

J. W. Blaylock, P. W. O'Keefe, J. N. Roehm, and R. E. Wildung.

In: Prevention and Control of Oil Spills, Proceedings of Joint Conference, Washington, DC, March 13-15, 1973. p 173-177, 2 fig, 2 tab, 5 ref.

Descriptors: \*Shellfish, \*Oil pollution, \*Toxicity, Water pollution sources, Aquatic animals, \*Bioassay, \*Water pollution, Solvent extractions. Identifiers: \*N-alkane, \*Methylnaphthalene, Hydrocarbons, Petroleum, Tissue digestion, Column separation.

During the course of investigations to determine the possible toxicity of petroleum to marine biota, it became evident that quantitative estimates of the petroleum components in water and biota would assist in meaningful interpretation of the results of bioassays. A method originally utilized for determination of polycyclic aromatic hydrocarbons in foods was adapted for the digestion of tissue and extraction of hydrocarbons from shellfish exposed to petroleum during bioassays. Tissue extracts were partitioned into saturate and aromatic fractions by column chromatography. Using gas-liquid chromatography, the n-alkanes of carbon numbers 12 to 19, and the methyl substituted naphthalenes were identified in the saturate and aromatic fractions, respectively. Both groups of compounds were quantitated by reference to an internal standard. The procedure allowed recovery of over 70% of n-alkanes and methylnaphthalenes applied to the tissues prior to digestion. Minimum detectable levels for n-alkanes and methylnaphthalenes were approximately 0.08 to 0.15 and 0.03 to 0.04 microgram/g of wet tissue, respectively. (See also W76-09312) (Sinha-OEIS) W77-00220

#### IDENTIFICATION OF OIL POLLUTANTS: A REVIEW OF SOME RECENT METHODS,

National Environmental Research Center, Edison, N. J. Edison Water Quality Research Div.

M. Gruenfeld. In: Prevention and Control of Oil Spills, Proceedings of Joint Conference, Washington, DC, March 13-15, 1973. p 179-193, 9 fig, 11 tab, 5 ref, append.

Descriptors: \*Pollutant identification, \*Oil spills, \*Oil pollution, Water pollution, \*Gas chromatography, \*Spectrophotometry, \*Methodology. Identifiers: \*Outer Continental Shelf, Passive tagging, Crude oils, Spectrometry.

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5A—Identification Of Pollutants

Some recent studies of methods for identifying weathered oils through chemical fingerprints (passive tagging) are reported. These studies were performed by Esso Research and Engineering Company, Phillips Scientific Corporation, Woods Hole Oceanographic Institution, and Baird Atomic Corporation under U.S. Environmental Protection Agency (EPA) sponsored grants and contracts. A broad range of analytical instruments and techniques were used, e.g., adsorption chromatography, molecular emission and absorption spectrophotometry, atomic absorption spectrophotometry, gas chromatography, computerized mass spectrometry, et. al. Some of the oil parameters evaluated as potential fingerprint indices are vanadium, nickel, sulfur and nitrogen content, gas chromatographic profile appearance, carbon and sulfur isotope ratios, API gravity, and pour point. Several promising methods for passive tagging oils are suggested by these studies. (See also W76-09312) (Sinha-OEIS) W77-00221

**A MULTIPARAMETER OIL POLLUTION SOURCE IDENTIFICATION SYSTEM,** Phillips Petroleum Co., Bartlesville, Okla. Research Div. J. W. Miller.

In: Prevention and Control of Oil Spills, Proceedings of Joint Conference, Washington, DC, March 13-15, 1973. p 195-203, 6 fig, 2 tab, 10 ref. EPA-No. 68-01-0059.

Descriptors: \*Pollution identification, \*Water pollution sources, \*Oil spills, \*Oil pollution, Tagging, Transportation, Laboratory tests, Organic compounds.

Identifiers: \*Outer Continental Shelf, Crude oil.

The key parameters of carbon and sulfur isotopic composition, total sulfur, nitrogen, vanadium, nickel and normal paraffin odd-even carbon number predominance were measured on the 600+F residue, which simulates a weathered sample of crude oil. The variation of these parameters among 80 crude oils representative of worldwide sources of water-transported oils forms the basis of an identification system. The parameter range was carbon isotopic composition, -22 to -30 per mil; sulfur isotopic composition, -14 to +20 per mil; total sulfur 0.05 to 6.0 weight per cent; nitrogen 0.02 to 0.73 weight per cent; vanadium 0.2 to 466 wppm; nickel 0.2 to 128 wppm; and odd-even carbon number predominance 0.8 to 1.3. An unknown oil is identified by comparison of these parameters with those in a data library or from suspected sources. A computer 'look-up' system was demonstrated to match any one of the 80 crude oils with an unknown. The identification potential is strengthened by addition of the diagnostic parameters of percentage saturates, aromatics and asphaltics as measured by silica gel chromatography and the gas-liquid chromatography hydrocarbon and sulfur profiles ('fingerprints'). (See also W76-09312) (Sinha-OEIS) W77-00222

**CHARACTERISTICS OF NATURALLY OCCURRING AND POLLUTANT HYDROCARBONS IN MARINE SEDIMENTS,** Paris Univ. (France). M. Tissier, and J. L. Oudin.

In: Prevention and Control of Oil Spills, Proceedings of Joint Conference, Washington, DC, March 13-15, 1973. p. 205-214, 12 fig, 1 tab, 31 ref.

Descriptors: \*Oil spills, \*Oil pollution, \*Pollutant identification, \*Water pollution sources, \*Toxicity, \*Environmental effects, \*Mud, Sediments, Aquatic animals, Ecosystems, Laboratory tests.

Identifiers: \*Outer Continental Shelf, French coast, Alkyl-aromatics, Aromatic hydrocarbons.

Hydrocarbons spilled on the sea may, naturally or by sinking agent, settle on the sea bed and pollute marine muds which are the substratum of the benthic fauna and flora. They may be adsorbed by these organisms which are the basis of the nutrition for a large part of the aquatic fauna. This hydrocarbon pollutants will enter by this way in the marine food chain and raise the problem of long term toxicity. It is important to measure the quantity of hydrocarbons in the marine sediments in order to know the level of pollution. A detailed analysis of the chloroform extract of the sediment by chromatography, mass spectrometry and U.V. fluorescence can discriminate between unpolluted and polluted sediments even in the case of low level pollution. It has been noted in the unpolluted samples (collected on the French coast of the English channel in Normandie and in the Seine Bay) a higher percentage of heavy products (resins and asphaltene), a more important odd carbon dominance in the n-alkanes distribution than in the polluted ones. The aromatic fraction of the indigenous hydrocarbons is mainly composed of polycyclic aromatic hydrocarbons without alkyl chains whereas polluted samples show many types of alkyl-aromatics. (See also W76-09312) (Sinha-OEIS) W77-00223

**COMPARATIVE IDENTIFICATION OF OIL SPILLS BY FLUORESCENCE SPECTROSCOPY FINGERPRINTING,**

Environmental Protection Agency, Edison, N. J. Surveillance and Analysis Div.; and Environmental Protection Agency, Edison, N. J. Region II. W. A. Coakley.

In: Prevention and Control of Oil Spills, Proceedings of Joint Conference, Washington, DC, March 13-15, 1973. p 215-222, 12 fig, 7 ref.

Descriptors: \*Oil spills, \*Oil pollution, \*Water pollution sources, \*Pollutant identification, Gas chromatography.

Identifiers: \*Outer Continental Shelf, \*Fluorescence spectroscopy, Emission spectrum.

A simple and rapid method for the comparative identification of oil spills with suspect source oils is described using fluorescence spectroscopy. The method involves the excitation of an oil, diluted in cyclohexane, at a distinct wavelength and obtaining a 'fingerprint' in the form of an emission spectrum. Contamination and weathering of the environmental oil is considered. The method is applied to two different oil spills occurring near the same area at about the same time. Results are confirmed by gas chromatography. (See also W76-09312) (Sinha-OEIS) W77-00224

**DETERMINATION OF HYDROCARBON SOLUBILITY IN SEA WATER AND THE ANALYSIS OF HYDROCARBONS IN WATER-EXTRACTS,** National Bureau of Standards, Washington, D. C. Inst. for Materials Research. S. P. Wasik, and R. L. Brown.

In: Prevention and Control of Oil Spills, Proceedings of Joint Conference, Washington, DC, March 13-15, 1973. p 223-227, 5 fig, 6 ref.

Descriptors: \*Oil spills, \*Oil pollution, \*Pollutant identification, \*Water pollution sources, \*Environmental effects, Sea water, Gas chromatography, Oceans, Toxicity, Solubility. Identifiers: \*Outer Continental Shelf, Hydrocarbons analysis.

An apparatus is described for measuring the solubility of hydrocarbons in sea water and for analyzing hydrocarbons in water-extracts. The relative concentrations of the hydrocarbons in the gas phase in equilibrium with the water extract were determined by gas chromatography. A known volume of the gas phase was purged out from the apparatus and replaced with helium. The concentration of the hydrocarbons were measured after

the second equilibration. The solubility of the hydrocarbon solutes in the sea water extract were determined from the peak area ratios of the solute peaks and the volume of the apparatus. Complex mixtures of hydrocarbons in aqueous solutions may be analyzed using this apparatus by examining the chromatograms obtained after each flush out. The peaks are identified as to hydrocarbon group (olefinic, aromatic, paraffinic) from the rate that the solute peak area decreased after each flush out. Overlapping peaks may be resolved using this technique. By extrapolating peak areas to zero flush out, the concentration of each solute in the original extract may be obtained. The analysis of a non-lead gasoline in sea water is presented. (See also W76-09312) (Sinha-OEIS) W77-00225

**THE TOXICITY TESTING OF OILS AND DISPERSANTS: A EUROPEAN VIEW,** Ministry of Agriculture, Fisheries and Food, London (England).

For primary bibliographic entry see Field 5G. W77-00229

**THE ISOLATION AND CHARACTERIZATION OF HYDROCARBON-UTILIZING BACTERIA FROM CHEDABUCTO BAY, NOVA SCOTIA,** Rhode Island Univ., Kingston. Dept. of Plant Pathology-Entomology. A. M. Cundell, and R. W. Traxler.

In: Prevention and Control of Oil Spills, Proceedings of Joint Conference, Washington, DC, March 13-15, 1973. p 421-426, 5 fig, 2 tab, 18 ref.

Descriptors: \*Oil spills, \*Oil pollution, \*Water quality control, Water pollution, \*Bacteria, Treatment, Seawater, Sediments, Littoral, \*Canada, Bays, Pollutant identification.

Identifiers: \*Outer Continental Shelf, Nova Scotia, Bunker oil, Fuel oil, Naphthalene, Bacterial flora, Olefinic hydrocarbons, Aromatic hydrocarbons, Chedabucto Bay (NS).

Hydrocarbon-utilizing bacteria were isolated by enrichment culture techniques from littoral sediments and seawater collected in Chedabucto Bay, Nova Scotia, in 1972. The sample area received major Bunker C oil pollution in February 1970. Enrichment substrates were naphthalene, and Nos. 1 and 6 fuel oils incubated at 0.8 and 25°C. Isolates have been obtained from samples of sediment and seawater on all enrichment substrates at temperatures of 25°C and 8°C. Each isolate has been shown to grow on seawater medium with No. 1 fuel oil as the substrate. The isolates were screened on n-hexane, n-dodecane, 2,2-dimethylhexane, methylcyclohexane, p-xylene, n-hexylbenzene, and naphthalene to demonstrate their profile of hydrocarbon utilization. Both aliphatic and aromatic hydrocarbon degrading bacteria were obtained from the samples. The relative rate of growth of each isolate on solid media with the various substrates has been determined at 0.8, 16 and 24°C. Viable cell counts in liquid culture with isolate 6-A7-25-1 were performed at 10°C and 20°C on naphthalene and n-hexadecane to determine generation time and lag time. (See also W76-09312) (Sinha-OEIS) W77-00244

**DEVELOPMENT OF METHODOLOGY AND APPARATUS FOR THE BIOASSAY OF OIL,** Battelle-Pacific Northwest Labs., Richland, Wash.

J. A. Lichatowich, P. W. O'Keefe, J. A. Strand, and W. L. Templeton. In: Prevention and Control of Oil Spills, Proceedings of Joint Conference, Washington, DC, March 13-15, 1973. p 659-666, 6 fig, 3 tab, 17 ref.

Descriptors: \*Bioassay, \*Oil spills, \*Oil pollution, \*Water quality control, \*Water pollution, Aquatic plants, Aquatic animals, \*Methodology.

Identifiers: \*Petroleum, Biological effects, Crude oil, Refined oil, Apparatus.

Techniques that may be applied in the bioassay of oil and other non-miscible materials are summarized. Bioassay procedures are described that are conducted in the flow-through tanks equipped with gravity oil metering systems and static mixers to equilibrate diluent water. Oil concentrations measured at different depths are utilized to calculate the mean level of exposure of the test organisms in the water column. Habitat preference and behavior of the test organism during bioassay were assessed in relationship to toxicity. (See also W76-09312) (Sinha-OEIS) W77-00266

**CHANGE OF THE BIOCHEMICAL COMPOSITION OF MUSSELS UNDER CONDITIONS OF REGULATED FLOW OF THE DNIPIER, (IN RUSSIAN),** Akademiya Nauk URSS, Kiev. Instytut Hidrobiologii. For primary bibliographic entry see Field 5C. W77-00281

**VERSATILE MULTIRANGE ANALYTICAL MANIFOLD FOR AUTOMATED ANALYSIS OF NITRATE-NITROGEN,** Agricultural Research Service, Watkinsville, Ga. W. A. Jackson, C. E. Frost, and D. M. Hildreth. Soil Science Society of America Proceedings, Vol. 39, No. 3, p 592-593, May-June 1975. 2 fig, 1 tab, 9 ref.

Descriptors: \*Nitrates, \*Nitrogen, Nutrients, Laboratory equipment, Laboratory tests, Soil chemistry, \*Pollutant identification, Automation, Analytical techniques. Identifiers: Technicon autoanalyzer, \*Nitrate-nitrogen.

A technique is described for extending up to 100 ppm the limits of determining nitrate-nitrogen in solution using a Technicon Autoanalyzer system. The same modified analytical manifold can be used to determine three concentration ranges of nitrate nitrogen 0-1, 0-10, and 0-100 ppm. To change concentration range, change the sample entry point in the manifold and standardize the instrument within the proper range. (Skogerboe-Colo St) W77-00285

**THE IMPACT OF MAN ON THE WORLD NITROGEN CYCLE,** Purdue Univ., Lafayette. Dept. of Agricultural Economics. B. McCarl, D. Raphael, and E. Stafford. Journal of Environmental Management, Vol. 3, No. 1, p. 7-19, January 1975. 2 fig, 4 tab, 4 ref.

Descriptors: \*Nitrogen, Atmosphere, \*Model studies, Chemical reactions, \*Nitrogen cycle, Environmental effects, \*Air pollution effects.

The atmosphere is a complex chemical system in which nitrogen emissions, resulting from man's occupancy of the earth, mix and interact with natural nitrogen emissions. By examining the flow of nitrogen within the world, it is possible to improve the understanding of how man's emissions affect the natural nitrogen cycle. Obviously the direct effects of man's nitrogen emissions are multiplied by the natural cycle. An attempt is made to determine the multiplier effect. Through the use of input-output methodology a system with homogeneous flow may be analyzed, finding the multiplier effects. Homogeneous flow is attained in the nitrogen cycle by converting all flows into their accompanying nitrogen content. The system is then modelled and a solution derived. One ton of man's nitrogen input is then seen to produce some 800 tons of flow. (Skogerboe-Colo St) W77-00312

**THE SPECTROPHOTOMETRIC DETERMINATION OF ARSENIC IN SEA WATER, POTABLE WATER, AND EFFLUENTS,** Liverpool Univ. (England). Dept. of Oceanography. M. G. Haywood, and J. P. Riley. Analytica Chimica Acta, Vol. 85, No. 2, p 219-230, September, 1976. 1 fig, 6 tab, 25 ref.

Descriptors: \*Water analysis, \*Pollutant identification, \*Arsenic compounds, \*Potable water, Sea water, Effluents, \*Spectrophotometry, Analytical techniques, Photometry, Copper, Nickel, Cadmium, Metals, Separation techniques, Ion exchange, Ultraviolet radiation, Oxidation, Trace elements, Water pollution sources, Water properties, Water chemistry, Heavy metals. Identifiers: Sodium borohydride, Silver, Bismuth, Nitric acid, Sulfuric acid, \*Arsenic.

Procedures are described for the determination of arsenic in sea water, potable waters, and effluents. The sample is treated with sodium borohydride added at a controlled rate. The arsine evolved is absorbed in a solution of iodine and the resultant arsenate ion is determined photometrically by a molybdenum blue method. For sea water the range, standard deviation, and detection limit are 1-4 micrograms/liter, 1.4%, and 0.14 micrograms/liter, respectively; for potable waters they are 0-800 micrograms/liter, about 1% (at 20 micrograms/liter) and 0.5 micrograms/liter, respectively. Silver and copper cause serious interference at levels of 0.5 micrograms/liter, and nickel, cadmium, and bismuth interfere at concentrations of a few tens of mg/liter; however, these elements can be removed either by preliminary extraction with a chloroform solution of dithizone or by ion-exchange. Arsenic present in organo-arsenic compounds is not directly determinable, but can be rendered reactive either by photolysis with ultraviolet radiation or by oxidation with permanganate or nitric/sulfuric acid mixture. Arsenic(V) can be determined separately from total inorganic arsenic after extracting arsenic(III) as its pyridine dithiocarbamate into chloroform. (Witt-IPC) W77-00319

**RE-ASSESSMENT OF CHELATING ION-EXCHANGE RESINS FOR TRACE METAL ANALYSIS OF SEA WATER,** Liverpool Univ. (England). Dept. of Oceanography. M. I. Abdullah, O. A. El-Rayis, and J. P. Riley. Analytica Chimica Acta, Vol. 84, No. 2, p 363-368, July 1976. 1 tab, 18 ref.

Descriptors: \*Ion exchange, \*Water analysis, \*Heavy metals, \*Trace elements, \*Pollutant identification, \*Sea water, Chelation, Copper, Cadmium, Lead, Zinc, Resins, Colloids, Acids, Digestion, Electrochemistry, Centrifugation, Adsorption, Separation techniques, Analytical techniques, Water pollution sources, Metals, Cations, Polarographic analysis. Identifiers: Voltametry.

The behavior of the chelating ion-exchange resin Chelex-100 for collection of trace metals from sea water has been studied by anodic stripping voltametry after acid digestion of the sea water sample and the resin effluent. All the naturally occurring electrochemically reducible species of Cu, Pb, Cd, and Zn are chelated by the resin; this fraction of these metals is regarded as the dissolved fraction. Centrifugation showed that some of the metal liberated by acid digestion is associated with colloidal species. Neither this nor the metal adsorbed on fine particles is affected or removed by the chelating resin. (Witt-IPC) W77-00320

**THE DETERMINATION OF ZINC, CADMIUM, LEAD AND COPPER IN A SINGLE SEA-**

**WATER SAMPLE BY DIFFERENTIAL PULSE ANODIC STRIPPING VOLTAMMETRY,** Liverpool Univ. (England). Dept. of Oceanography. M. I. Abdullah, B. R. Berg, and R. Klimek. Analytica Chimica Acta, Vol. 84, No. 2, p 307-317, July, 1976. 4 fig, 4 tab, 21 ref.

Descriptors: \*Water analysis, \*Heavy metals, \*Trace elements, \*Pollutant identification, \*Sea water, \*Zinc, \*Cadmium, \*Copper, Lead, Hydrogen ion concentration, Trace elements, Chemical analysis, Analytical techniques, \*Electrodes, Water pollution sources, Metals, Cations, Polarographic analysis. Identifiers: \*Voltametry, Gallium.

A comparative study is described of the anodic stripping voltametry of sea water at its natural pH and at acetate-buffered pH, with a mercury film electrode. The reproducibility of the oxidation current peaks for copper and lead is improved and the electrode memory effect decreases when the sample is acetate-buffered (pH 5.8). Determinations of zinc at the natural pH of sea water are inaccurate, because of the formation of Zn-Cu and Zn-Ni intermetallic compounds in the mercury film. The formation of such compounds can be prevented by the addition of gallium ions to acetate-buffered samples. A procedure for the determination of Cu, Pb, Cd, and Zn in sea water is described. (Witt-IPC) W77-00321

**CHLORINATED HYDROCARBON PESTICIDES IN WESTERN NORTH ATLANTIC OCEAN,** North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering. For primary bibliographic entry see Field 5B. W77-00325

**DETERMINATION OF VINYL CHLORIDE AT MICROGRAMS/LITER LEVEL IN WATER BY GAS CHROMATOGRAPHY,** Environmental Protection Agency, Cincinnati, Ohio. Office of Research and Development. T. A. Bellar, J. J. Lichtenberg, and J. W. Eichelberger. Environmental Science and Technology, Vol. 10, No. 9, p 926-930, September, 1976. 14 fig, 11 ref.

Descriptors: \*Water analysis, \*Gas chromatography, \*Pollutant identification, Analytical techniques, Trace elements, Chemical analysis, Water pollution sources, Water properties, Mass spectrometry, Silica, Gels, Organic compounds, Chemical wastes, Industrial wastes, Chlorides. Identifiers: \*Vinyl chloride, Chlorine compounds.

A quantitative method for the determination of vinyl chloride in water is presented. An inert gas is bubbled through the water sample to transfer the vinyl chloride to the gas phase. The vinyl chloride is concentrated on silica gel or Carbowax-B under noncryogenic conditions and determined by gas chromatography with a halogen-specific detector. The method was tested over a range of 4-40 micrograms/liter. Based on earlier work with similar compounds, a useful working range of 0.1-2500 micrograms/liter should be achievable. Gas chromatography-mass spectrometry methods for providing confirmatory identification of vinyl chloride are described. (Witt-IPC) W77-00326

**STATE OF WISCONSIN AUTOMATIC WATER QUALITY MONITORING SYSTEM FOR THE FOX AND WISCONSIN RIVERS,** Wisconsin Dept. of Natural Resources, Wisconsin Rapids. H. W. Weckwerth, P. J. Manor, and S. J. Kleinert. In: Proceedings of the International Seminar and Exposition on Water Resources Instrumentation, June 4-6, 1974, Chicago, Illinois, Ann Arbor Science Publishers, Ann Arbor, Michigan, Vol. 1, p 452-483, 1975. 13 fig, 7 tab.



## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5A—Identification Of Pollutants

**Descriptors:** \*Water quality, \*Monitoring, \*Wisconsin, \*Pulp wastes, \*Rivers, Data collections, Sampling, Water pollution sources, Water pollution, Pulp and paper industry, Hydroelectric plants, Dissolved oxygen, Water temperature, Hydrogen ion concentration, Electrical conductivity, Turbidity, Computers, Data processing, Maintenance, Repairing, Calibrations, Organic wastes, Remote sensing, Instrumentation, Automation.

**Identifiers:** \*Fox River(Wisc), \*Wisconsin River(Wisc).

An automatic monitoring system has been operated since 1971 to provide a continuous water quality record for the Upper Wisconsin and Lower Fox Rivers which receive large amounts of organic wastes from pulp and paper mills. Continuous monitoring of the streams is necessary to document improvements in water quality expected as results of the implementation of pollution-abatement programs, and to identify locations where further efforts will be needed. The system utilizes remote monitors installed at hydroelectric plants and paper mills. It comprises 6 stations that monitor dissolved oxygen, temperature, pH, and electroconductivity on the Upper Wisconsin and 5 stations that monitor the same four variables plus turbidity on the Lower Fox. All monitors are unattended and measure each parameter by means of probes placed in the water flow. Electric signals for all parameters are sent hourly via telephone wire to a central computer in Madison which receives, records, and summarizes 1,176 water quality measurements daily. Practical considerations of system maintenance, repair, calibration, and accuracy are reviewed. (Brown-IPC)

W77-00334

**COLOR REMOVAL FROM SOFTWOOD KRAFT CAUSTIC EXTRACT EFFLUENT BY POLYAMINES,**  
Institute of Paper Chemistry, Appleton, Wis.  
For primary bibliographic entry see Field 5D.  
W77-00335

**AUTOMATIC DETERMINATION OF WASTE WATER CHARACTERISTICS (AUTOMATISCHE BESTIMMUNG VON ABWASSERKENNGROSSEN),**  
Technische Universität, Darmstadt (West Germany). Wasser- und Abwasserforschungsstelle. H. L. Dalpke, and L. Gottsching.  
Das Papier, Vol. 30, No. 7, p 303-312, July, 1976. 5 tab, 7 ref.

**Descriptors:** \*Waste water(Pollution), \*Pulp wastes, \*Water analysis, \*Sampling, \*Automation, Optical properties, Suspended solids, Biochemical oxygen demand, Chemical oxygen demand, Oxygen demand, Organic compounds, Carbon, Toxicity, Trace elements, Instrumentation, Effluents, Pulp and paper industry, Industrial wastes, Pollutant identification.

**Identifiers:** \*Automated sampling.

A review is presented surveying possibilities for automated sampling of waste water as well as for automated measurement of waste water volume, optical properties, concentration of suspended materials, BOD, COD, total oxygen demand, total organic carbon, and toxicity, and determination of trace elements and organic components. In particular, five commercial systems for automated determination of COD, total oxygen demand, and/or total organic carbon are described and evaluated, particularly with respect to their suitability in analyzing pulp and paper mill effluents. (Speckhard-IPC)

W77-00338

**VARIABILITY OF AMINO ACID COMPOSITION OF ALGAE INHABITING THE ZONE OF VARIABLE SALINITY, (IN RUSSIAN),**  
Polyarnyi Nauchno-Issledovatel'skii i Proektnyi Institut Morskogo Rybnogo Khozyaistva i Okeanografii, Murmansk (USSR).  
M. F. Perlyuk, V. S. Zlobin, and T. A. Orlova.  
Gidrobiol Zh 10(6), p 53-58, 1974.

**Descriptors:** \*Amino acids, \*Pollutant identification, \*Algae, \*Chromatography, \*Salinity, Variability.

**Identifiers:** \*Fucus-vesticulosus, Methionine, Proline, Tryptophan, Valine, Osmotic regulation, Paper chromatography.

Paper chromatography indicated 19 amino acids in quantities of 0.6-1.6% fresh weight in hydrolysates of *Fucus vesiculosus* grown at salinities ranging from 3-34‰. Maximum amino acid concentration was found at 8.41‰ and minimum at 23.33‰. Methionine, valine, tryptophan and proline play the most active roles in osmotic regulation.—Copyright 1976, Biological Abstracts, Inc.

W77-00345

**MICROORGANISMS AS INDICATORS OF THE ENVIRONMENTAL HYGIENE: ECOLOGY, TAXONOMY AND ENUMERATION, (IN DUTCH),**  
Ghent Rijksuniversiteit (Belgium). Inter-Faculty Centre for Environmental Sanitation.  
W. Verstraete, and J. P. Voets.  
Natuurwet Tijdschr 57(2), p 41-84, 1975.

**Descriptors:** \*Bioindicators, \*Microorganisms, \*Systematics, \*Ecology, Water quality standards, *E. coli*, Coliforms, Public health, Viruses, Streptococcus, Potable water, Pollutant identification.

**Identifiers:** Clostridium-perfringens, Enteroviruses, Pseudomonas-aeruginosa.

A survey is presented of the different microorganisms which can be used as indicators of environmental hygiene (fecal coli, fecal streptococci, Clostridium perfringens, enteroviruses, Pseudomonas aeruginosa; in drinking water, recreational water, swimming pools). Special attention is drawn to their ecology and taxonomic identification. Relationships between the different indicator organisms and some important hygienic criteria are discussed.—Copyright 1976, Biological Abstracts, Inc.

W77-00348

**NITROGEN IN SOIL CORES AND GROUND WATER UNDER ABANDONED CATTLE FEEDLOTS,**  
Agricultural Research Service, Lincoln, Nebr. Animal Waste Management Research Unit.  
For primary bibliographic entry see Field 5B.  
W77-00365

**GEOLOGIC NITROGEN IN PLEISTOCENE LOESS IN NEBRASKA,**  
Nebraska Univ., Lincoln. Dept. of Agronomy.  
For primary bibliographic entry see Field 5B.  
W77-00366

**CHEMILUMINESCENCE METHOD OF DETERMINING COPPER IN NATURAL WATERS, (IN RUSSIAN),**  
Akademiya Nauk URSS, Kiev. Institut Hidrobiologii.  
N. A. Truba, and B. I. Nabivanets.  
Gidrobiol Zh. 11(2), p 125-128, 1975.

**Descriptors:** \*Analytical techniques, \*Copper, Natural streams, Reservoirs, Chemical reactions, \*Oxidation, \*Pollutant identification, \*Water analysis, Photometry.

**Identifiers:** \*Luminescence, USSR, \*Chemiluminescence, Kiev reservoir, Dnepr-Bug liman, Luminol.

Cu was determined by the chemiluminescence method in the Kiev Reservoir and Dnepr-Bug Liman (USSR). To establish the total Cu content in natural waters, the preliminary breakdown of organic compounds is necessary. The chemiluminescence method of analysis is based on the catalytic reaction of oxidation of luminol by cyanide complexes of Cu with the use of a chemiluminescence photometer.—Copyright 1976, Biological Abstracts, Inc.

W77-00404

**MANGANESE IN FRESH WATERS, (IN RUSSIAN),**  
Akademiya Nauk URSS, Kiev. Institut Hidrobiologii.  
E. P. Nakhshina.  
Gidrobiol Zh. 11(2), p 98-114, 1975.

**Descriptors:** \*Freshwater, \*Manganese, Rivers, Lakes, Reservoirs, Plankton, Bacteria, Water circulation, Flow, Diatoms, Chlorophyll, Reviews, Dissolved solids, Path of pollutants.

**Identifiers:** \*Manganese complexes.

A review is given of the literature on the chemistry of Mn and Mn complexes in natural waters; quantitative characteristics of Mn dissolved in rivers, lakes and reservoirs; routes of migration; and methods of determining various forms of Mn in natural waters. (The role of Mn in the activity of diatoms, Chlorophyll, plankton, higher aquatic plants and bacteria is mentioned.)—Copyright 1976, Biological Abstracts, Inc.

W77-00405

**HYDROGEOCHEMICAL INVESTIGATION OF THE DANUBE WATER IN AUSTRIA DURING THE YEARS 1971 AND 1972, (IN GERMAN),**  
Bundesversuchs- und Forschungsanstalt Arsenal, Vienna (Austria).  
E. Schroll, H. Krachschberger, and P. Dolezel.  
Arch Hydrobiol Supplementb. 44(4), p 492-514, 1975. (Engl. Summ.).

**Descriptors:** \*Rivers, \*Sampling, \*Water levels, Analyses, Suspended solids, Chemical analysis, Spectroscopy.

**Identifiers:** \*Austria, \*Danube River, Spectrochemical analysis, Atomic absorption.

The water of the Danube was sampled at 6 points in Austria during periods of highest and lowest water levels. Suspended substances were analyzed for more than 40 elements with the aid of atomic absorption and spectrochemical and chemical methods. The results are compiled in tables. Compared with other European streams the Danube River is scarcely polluted with inorganics. Correlations between the water level and the chemical constitution of dissolved and mechanically transported substances were found.—Copyright 1976, Biological Abstracts, Inc.

W77-00406

**THE IMPORTANCE OF BACTERIOLOGICAL INVESTIGATIONS FOR THE CLASSIFICATION OF FLOWING WATER BODIES, DEMONSTRATED ON THE AUSTRIAN PART OF THE DANUBE, (IN GERMAN),**  
Bundesanstalt fuer Wasserguete, Vienna (Austria).  
W. Kohl.  
Arch Hydrobiol Supplementb. 44(4), p 392-461, 1975.

**Descriptors:** \*Rivers, \*Water quality, \*Bacteria, \*Bioindicators, Analytical techniques, Water pollution, \*Pollutant identification.

**Identifiers:** \*Austria, \*Danube River.

Results of bacteriological investigations on the Danube and its tributaries demonstrate the sensitivity and selectivity of these parameters and their value as precise water quality indicators. The

efficiency of the suggested technique can be considerably increased by including other components of the limnic ecosystem and assessing their bacteriological contamination.—Copyright 1976, Biological Abstracts, Inc.  
W77-00407

**HYDROGEOLOGIC DATA FROM THE GREAT BEND PRAIRIE, SOUTH-CENTRAL KANSAS,**  
Geological Survey, Lawrence, Kans.  
For primary bibliographic entry see Field 4B.  
W77-00426

**WATER RESOURCES DATA FOR ALABAMA, WATER YEAR 1975.**  
Geological Survey, Tuscaloosa, Ala.  
For primary bibliographic entry see Field 7C.  
W77-00435

**SUITABILITY OF CONTAINERS FOR STORAGE OF WATER SAMPLES,**  
Australian Mineral Development Labs., Adelaide.  
D. C. Bowditch, C. R. Edmond, P. J. Dunstan, and J. A. McGlynn.  
Australian Water Resources Council, Canberra, Technical Paper No. 16, 1976. 39 p, 17 tab, 20 ref.

Descriptors: \*Water analysis, \*Water quality, \*Sampling, \*Laboratory tests, Chemical analysis, Plastics, Aluminum, Phosphorus compounds, Silica, Zinc.  
Identifiers: \*Storage containers, Glass.

Despite an increasing use of field monitoring instruments, the usual method of water quality assessment is by field sampling and subsequent analysis in the chemical laboratory. A step in this sequence is the storage of the sample in a container; any change in water quality occurring during the storage step will yield laboratory analysis which does not reflect the quality of the water as originally sampled. A study undertaken to detect interactions between containers and water samples found that most of the 25 water quality parameters (mineral analyses) tested were satisfactorily represented after storage in containers made from low or high density polyethylene or from soft glass. The exceptions were: orthophosphate was apparently adsorbed by high density polyethylene or soft glass, unless the materials were iodine-impregnated; and glass containers were unsatisfactory for silica, aluminum and zinc determinations. (CSIRO)  
W77-00436

**TRACE-METAL LEVELS IN THE WATERS AND SEDIMENTS OF CORIO BAY (AUSTRALIA),**  
Melbourne Univ., Parkville (Australia). School of Chemistry.  
H. T. French, and P. J. Thistlethwaite.  
Proceedings of the Royal Australian Chemical Institute, Vol 43, No. 3, p 73-79, March 1976. 5 fig, 3 tab, 18 ref.

Descriptors: \*Heavy metals, Water pollution sources, \*Bays, \*Australia, Analytical techniques, \*Cadmium, \*Copper, \*Lead, \*Zinc, Industrial wastes, Spectroscopy, Sampling, Bottom sediments, Adsorption, Pollutant identification.  
Identifiers: \*Corio Bay(Vic), Geelong(Vic), Anodic stripping voltammetry, Atomic absorption spectroscopy.

Levels of copper, cadmium, lead and zinc were determined in samples of water and sediment from four sites in Corio Bay in southern Victoria, an area of potentially high metal pollution due to low water circulation and proximity to the industrial area of Geelong. A report is presented which emphasises techniques of sampling and analysis for valid results. Water samples were tested by anodic stripping voltammetry and by atomic absorption spectroscopy using both solvent extrac-

tion and ion exchange for preconcentration; sediments by conventional atomic absorption spectroscopy. The distribution of metal contents found in the water was consistent with the known sources of pollution. It was found that high surface areas of sediments were associated with high metal contents, supporting a hypothesis that removal of heavy metal from water involves adsorption onto fine particulate matter. (CSIRO)  
W77-00446

**STOICHIOMETRIC DISTANCE AND TOTAL CONCENTRATION: A BINARY NUMERICAL DESCRIPTION OF INLAND WATER CHEMISTRY,**  
Tasmania Univ., Hobart (Australia). Dept. of Botany.  
For primary bibliographic entry see Field 2K.  
W77-00449

**HYDROGEOCHEMISTRY OF THE GENOA RIVER BASIN, NEW SOUTH WALES - VICTORIA (AUSTRALIA),**  
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Environmental Marine Geology.  
For primary bibliographic entry see Field 2K.  
W77-00452

**TOWARDS METHOD STANDARDIZATION: E. COLI COUNTS IN WATER SAMPLES USING MEMBRANE FILTERS, (IN TURKISH),**  
Hacettepe Universitesi, Ankara (Turkey). Dept. of Microbiology.  
M. Akman.  
Mikrobiyol Bul 9(3), p 257-265, 1975.

Descriptors: \*Water quality standards, \*Pollutant identification, Bacteria, \*E coli, Filters, \*Sampling, Turkey.  
Identifiers: \*Europe, \*Membrane filters.

The membrane filter technique in routine bacteriological examination of water samples for *Escherichia coli* is described. This method presently is not routinely used in Turkey.—Copyright 1976, Biological Abstracts, Inc.  
W77-00453

**IDENTIFICATION AND ANALYSIS OF ORGANIC POLLUTANTS IN WATER.**  
Environmental Protection Agency, Athens, Ga. Southeast Environmental Research Lab.  
Ann Arbor Science Publishers, Ann Arbor, Michigan. 1976. 718 p. Keith, L. H. (editor).

Descriptors: \*Water analysis, \*Pollutant identification, \*Organic compounds, \*Waste water(Pollution), Wastes, Chemical wastes, Water pollution sources, Chemistry, Analytical techniques, Gas chromatography, Trace elements, Separation techniques, Mass spectrometry, Chromatography, Chemical analysis, Explosives, Polarographic analysis, Potable water, Groundwater, Lakes, Surface waters, Domestic wastes, Industrial wastes, Pulp wastes, Bleaching wastes, Organic wastes.  
Identifiers: Carcinogens, Halogen compounds.

Of the 36 chapters in this compilation, 32 came from a symposium on water pollutant analysis held at the 1st Chemical Congress of the North American Continent, Mexico City, December, 1975. They are grouped under three headings: Chemistry of pollutants (foundations of organic pollutant analysis, chemistry of potential polyhalogenated water pollutants, photodecomposition of halogenated aromatic compounds, and chemical carcinogens in the environment); Techniques and methods of analysis (covering, for example, use of gas chromatographic/mass spectrometric techniques in the analysis of unusual environmental chemicals, analysis of refractory pollutants in water by high-resolution liquid chromatography, determination of organic explosives in water by

single-sweep polarography); and Identification of organic pollutants (in drinking water, groundwater, lakes, and other surface waters, and in domestic and industrial effluents, including kraft pulp and paper mill and bleach plant effluents). (See W77-00456 thru W77-00459) (Brown-IPC)  
W77-00455

**GS/MS (GAS CHROMATOGRAPHIC/MASS SPECTROMETRIC) ANALYSES OF ORGANIC COMPOUNDS IN TREATED KRAFT PAPER MILL WASTEWATERS,**  
Environmental Protection Agency, Athens, Ga. Southeast Environmental Research Lab.  
L. H. Keith.

In: Identification and Analysis of Organic Pollutants in Water (Keith, L. H., editor), Ann Arbor Science Publishers, Ann Arbor, Michigan, p 671-707, 1976. 10 fig, 5 tab, 26 ref.

Descriptors: \*Pulp wastes, \*Organic compounds, \*Pollutant identification, \*Waste water treatment, Wastes, Industrial wastes, Gas chromatography, Mass spectrometry, Water pollution sources, Waste treatment, \*Georgia, Trickling filters, Aerated lagoons, Lime, Flocculation, Oxidation ponds, Biochemical oxygen demand, Phenols, Biological treatment, Treatment facilities, Pollutants, Analytical techniques, Water pollution treatment, Organic acids, Persistence.  
Identifiers: Terpenes, Resin acids, Total organic carbon, Fatty acids, Kraft mills, Board mills.

Effluents from 2 integrated kraft board mills in Georgia were sampled at various points in their waste treatment systems. Gas chromatography of the organic extracts and identification of many specific compounds by combined gas chromatography/mass spectrometry provided a chemical profile of these effluents. Raw waste water compositions of both mills were similar, but treatments differed. One mill (an unidentified linerboard producer) used trickling filters with aerated lagoons; the other (Interstate Paper Corp., Riceboro) used lime flocculation plus stabilization lagoons. Despite these differences, the treated waters showed similar qualitative compositions, although individual components (especially fatty acids) varied quantitatively. When raw and treated effluents were resampled 2 years later, concentrations of organics were different, but the same volatiles were still present. It is concluded that the volatile organic composition of kraft effluents (amounting to 1 to 10% of TOC) remains fairly constant as long as raw materials and manufacturing processes remain unchanged. Because of rapid fluctuations in the amounts of effluent organics, composite samples are needed for representative quantitative analyses. Both treatment systems achieved 85-90% reductions in BOD, 75-80% drops in volatile acids and volatile phenols, and 90% or better reductions in terpenes. Chemico-biological treatment reduced the TOC by 80-85%, total resin acids by 74% (to 6.4 mg/liter), and total phenols by 94% (to 0.2 mg/liter), compared to 66-65%, 87% (to 1.4 mg/liter), and 73% (to 0.6 mg/liter) for biological treatment alone. Treated effluents from both mills contained more fatty acids (branched and odd-numbered carbon compounds) than did the raw waste waters, probably derived from metabolites of aquatic pond organisms. (See also W77-00455) (Brown-IPC)  
W77-00456

**FATE OF SELECTED ORGANIC COMPOUNDS IN THE DISCHARGE OF KRAFT PAPER MILLS INTO LAKE SUPERIOR,**  
Canada Centre for Inland Waters, Burlington, (Ontario).  
For primary bibliographic entry see Field 5B.  
W77-00457

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5A—Identification Of Pollutants

**PERSISTENT ORGANIC COMPOUNDS FROM A PULP MILL IN A NEAR-SHORE FRESH-WATER ENVIRONMENT.**  
Canada Centre for Inland Waters, Burlington, (Ontario).  
For primary bibliographic entry see Field 5B.  
W77-00458

**IDENTIFICATION OF TWO CHLORINATED GUAIACOLS IN KRAFT BLEACHING WASTE-WATERS.**  
Fisheries and Marine Service, West Vancouver (British Columbia). Pacific Environment Inst.  
I. H. Rogers, and L. H. Keith.  
In: Identification and Analysis of Organic Pollutants in Water (Keith, L. H., editor), Ann Arbor Science Publishers, Ann Arbor, Michigan, p 625-639, 1976. 4 fig, 2 tab, 16 ref.

Descriptors: \*Bleaching wastes, \*Phenols, \*Pollutant identification, Gas chromatography, Mass spectrometry, Wastes, Industrial wastes, Water pollution sources, \*Toxicity, Water pollution effects, Fishkill, Lignins, Biological treatment, Analytical techniques, Pollutants, Organic compounds, Effluents, \*Canada.  
Identifiers: \*Guaiacols, Kraft mills, Resin acids, Chlorine compounds, Coho Salmon.

Trichloroguaiacol concentrations up to 57% of the LC(50) value and tetra-chloroguaiacol levels up to 32% of the LC(50) value were measured in kraft mill bleach plant (alkaline extraction stage) effluents. The toxicity associated with these compounds can explain at best only a fraction of the caustic effluent's overall toxicity which caused fish kill at 10% concentration. Among other compounds identified, only resin acids (present in very low concentrations) were known toxicants. Undetected compounds contributing much of the observed toxic effect may be chlorinated lignin residues with molecular weights too high for gas chromatographic analysis. A sample of whole-mill kraft effluent discharged after biological treatment in a 5-day lagoon was acutely toxic to fish at 65% concentration and contained no detectable resin acids. Gas chromatographic/mass spectrometric analyses revealed over 100 compounds, many of them chlorinated, including tri- and tetrachloroguaiacol in concentrations of 98 and 70 micrograms/liter, respectively. (See also W77-00455) (Brown-IPC)  
W77-00459

**NATIONAL CONFERENCE ON POLYCHLORINATED BIPHENYLS (NOVEMBER 19-21, 1975, CHICAGO, ILLINOIS), PROCEEDINGS.**  
Environmental Protection Agency, Washington, D.C. Office of Toxic Substances.  
For primary bibliographic entry see Field 5B.  
W77-00460

**REVIEW OF PCB (POLYCHLORINATED BIPHENYLS) IN THE ENVIRONMENT.**  
Environmental Protection Agency, Washington, D.C. Office of Toxic Substances.  
For primary bibliographic entry see Field 5B.  
W77-00463

**CHLORINATED GUAIACOLS IN BLEACHERY WASTES: COMMENTS ON A PAPER BY LEACH AND THAKORE.**  
Fisheries and Marine Service, West Vancouver (British Columbia). Pacific Environment Inst.  
I. H. Rogers.  
Journal of the Fisheries Research Board of Canada, Vol. 33, No. 8, p 1858-1860, August, 1976. 1 fig, 7 ref.

Descriptors: \*Pulp wastes, \*Bleaching wastes, \*Phenols, \*Pollutant identification, \*Toxicity, Pulp and paper industry, Effluents, Salmonids, Water pollution sources, Wastes, Industrial

wastes, Water pollution effects, Organic compounds.  
Identifiers: 3,4,5-Trichloroguaiacol, 3,4,5,6-Tetrachloroguaiacol, Chlorine compounds, Kraft mills, \*Chlorinated guaiacols.

Tri- and tetrachloroguaiacol are constituents of kraft bleaching wastes which are acutely toxic to salmonids. There are four possible structural isomers of trichloroguaiacol, and no evidence was presented by Leach and Thakore to support their claim that the compounds they found had the 3,4,5-substitution pattern; cf. Journal of the Fisheries Research Board of Canada, Vol. 32, No. 8, p 1249-1257, August, 1975. (See W76-02332). Details as to how Leach and Thakore synthesized their standard chlorinated guaiacols were not presented. Identification of chlorinated resin acids and epoxides derived from unsaturated fatty acids is considered to indicate poor pulp washing efficiency, and Rogers has not observed such compounds in caustic extraction effluents from mills he has studied. (See also W77-00468) (Witt-IPC)  
W77-00467

**(CHLORINATED GUAIACOLS IN BLEACHERY WASTES—) RESPONSE TO THE COMMENTS OF I. H. ROGERS.**  
B. C. Research Ltd., Vancouver.  
J. M. Leach, and A. N. Thakore.  
Journal of the Fisheries Research Board of Canada, Vol. 33, No. 8, p 1860-1861, August, 1976. 3 ref.

Descriptors: \*Pulp wastes, \*Phenols, \*Bleaching wastes, \*Pollutant identification, \*Toxicity, Pulp and paper industry, Effluents, Water pollution sources, Water pollution effects, Organic compounds, Wastes, Industrial wastes.  
Identifiers: 3,4,5-Trichloroguaiacol, 3,4,5,6-Tetrachloroguaiacol, Chlorine compounds, Kraft mills, \*Guaiacols.

In a previous article the authors claim that 3,4,5-tri- and 3,4,5,6-tetrachloroguaiacol are important toxic constituents of caustic extraction effluents from kraft pulp mill bleach plants; cf. Journal of the Fisheries Research Board of Canada, Vol. 32, No. 8, p 1249-1257, August, 1975. Rogers' contention that these compounds are not present in these effluents (cf. Journal of the Fisheries Research Board of Canada, Vol. 33, No. 8, p 1858-1860, August, 1976) is rebuked by the authors. (See also W77-00467) (Witt-IPC)  
W77-00468

**GROUND-WATER DATA FOR ATTALA COUNTY, MISSISSIPPI.**  
Geological Survey, Jackson, Miss.  
For primary bibliographic entry see Field 7C.  
W77-00484

**GROUND-WATER QUALITY IN THE DAVIE LANDELL, BROWARD COUNTY, FLORIDA.**  
Geological Survey, Tallahassee, Fla.  
For primary bibliographic entry see Field 5B.  
W77-00486

**SPECIES DIVERSITY OF FRESHWATER PLANKTON AGGLOMERATIONS, (IN POLISH).**  
For primary bibliographic entry see Field 7B.  
W77-00495

### 5B. Sources Of Pollution

**CAPACITY OF A SPARTINA SALT MARSH TO ASSIMILATE NITROGEN FROM SECONDARILY TREATED SEWAGE.**  
Georgia Univ., Sapelo Island Marine Inst.  
A. G. Chalmers, E. B. Haines, and B. F. Sherr.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-258 640, Price codes: A05 in paper copy, A01 in microfiche. Georgia Environmental Resources Center, Atlanta, Report No. ERC 0776, July 1976. 88 p, 21 fig, 26 tab, 54 ref. OWRT A-057-GA(1). 14-31-0001-5010.

Descriptors: \*Sewage sludge, \*Nitrogen, \*Salt marshes, \*Denitrification, \*Georgia, Sludge treatment, Sludge disposal, Soil analysis, Waste assimilative capacity, Plant growth, Fertilization.  
Identifiers: \*Spartina alterniflora.

Air-dried, pulverized secondarily treated sewage sludge was applied to duplicate 100 m<sup>2</sup> plots in a short Spartina high marsh near Sapelo Island, Georgia, at a rate of 200 g sludge, or 4 g nitrogen per square meter every two weeks for 12 months. Monthly measurements were made of nitrogen pools in the marsh plants and soils in the experimental plots and in duplicate control plots in the high marsh and in a low marsh area. Potential denitrification rates were also analysed for marsh soils in the study sites. Sludge fertilization of the salt marsh resulted in increased plant growth, increased content of total nitrogen in the surface marsh soils, and increased concentration of exchangeable ammonium in the top 30 cm of the soil profile. Contrary to expectation, the sludge appeared to inhibit the activity of denitrifying bacteria in the marsh soils. At the end of the study, only 50% of the sludge nitrogen applied remained on the plots, most in the surface soil. Since the natural rate of sedimentation is low in the Georgia salt marshes, the missing nitrogen was probably washed off the plots via tidal flow. There were no major differences between nitrogen pools in the control low and high marsh areas; however, the data suggested that greater mineralization rates of organic matter in low marsh soils could result in the differences in vigor and productivity between low and high marsh Spartina plants which can be ascribed to nitrogen availability.  
W77-00003

**BEHAVIOR OF MERCURY IN SUSPENDED SOLIDS AND BOTTOM SEDIMENTS.**  
Tennessee Technological Univ., Cookeville. Dept. of Civil Engineering.  
For primary bibliographic entry see Field 5C.  
W77-00007

**IMPACT OF LAND DISPOSAL OF SLUDGES ON GROUNDWATER.**  
Geraghty and Miller, Port Washington, N.Y.  
G. R. Wilson.

In: Proceedings of the 1975 National Conference on Municipal Sludge Management and Disposal, August 18-20, 1975, Anaheim, California, p 193-199. 5 fig, 2 tab, 16 ref.

Descriptors: \*Pollutant identification, \*Sludge disposal, \*Land use, \*Groundwater, \*Water quality, Hydrologic aspects, Evaluation, Sites.

The many problems involved in evaluating the impact of land disposal of sludges on groundwater quality are discussed, with particular emphasis on the hydrologic aspects. The purpose of the discussion is to direct attention to the complexity of the subject, and to suggest some practical considerations that may be applied in evaluating potential disposal sites. The factors governing the chemical and transport behavior of contaminants through the zone of aeration and in the aquifer are enormously complex. At present there appears to be little prospect of any accurate prediction of them prior to the emplacement of sludge, or any other potential contaminant source. This situation may be rectified by theoretical and laboratory studies and by data from field investigations. It is possible to draw up guidelines for land disposal of both sludge and effluent, and this has been done by numerous agencies. These guidelines, however, cannot be definitive. Each proposed disposal site must



be studied and evaluated individually. (See also W77-00009) (Snyder-FIRL)  
W77-00031

**DYNAMICS OF THE COMPOSITION AND THE QUALITIES OF WATER-SOLUBLE ORGANIC SUBSTANCE DURING THE COMPOSTING OF CLOVER AND TIMOTHY ROOTS, (IN RUSSIAN),**  
Leningrad State Univ. (USSR)  
V. N. Simakov, and A. V. Zhigunov.  
Vestn Leningr Univ Biol. 1, p 116-121, 1975.

Descriptors: \*Clovers, Chemical degradation, Chemical reactions, \*Humus, Organic matter, \*Water pollution sources.  
Identifiers: \*Composting, Organic, \*Timothy roots.

The changes in the chemical composition of the substances and their molecular weight correlations indicate the different processes of humification, the stability of the substances dissolved in water and the humin-like substances generated. The humin-like substances are precipitated by acid from the fractions with molecular weight 10,000.--  
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W77-00062

**TRACE ORGANIC COMPONENTS AS FINGER-PRINTS IN GAS CHROMATOGRAPHIC IDENTIFICATION OF SPILLED ASPHALTS,**  
Environmental Monitoring and Support Lab., Cincinnati, Ohio.  
For primary bibliographic entry see Field 5A.  
W77-00085

**THE RELATION OF AEROGENIC TO ANAEROGENIC AEROMONADS OF THE 'HYDROPHILA-PUNCTATA-GROUP' IN RIVER WATER DEPENDING ON THE POLLUTION LEVEL, (IN GERMAN),**  
Frankfurt Univ. (West Germany). Hygiene-Institut.  
For primary bibliographic entry see Field 5C.  
W77-00112

**A PHOSPHORUS RESIDENCE TIME MODEL: THEORY AND APPLICATION,**  
Texas Univ. at Dallas, Richardson. Inst. for Environmental Sciences.  
W. C. Sonzogni, P. C. Uttormark, and G. F. Lee.  
Water Research, Vol. 10, No. 5, p 429-435, 1976. 2 fig, 1 tab, 25 ref.

Descriptors: \*Phosphorus, \*Lakes, \*Environmental engineering, \*Mathematical models, Management, Nutrients, Sedimentation rates, Equations, Systems analysis, \*Water quality control, \*Path of pollutants.  
Identifiers: \*Residence time model, \*Chemical modeling, Steady state.

Chemical residence time has been used as a basis for modeling the chemical content of the ocean for some time. Recently, the chemical residence time approach has been used to model the rate of recovery of several lakes following pollution abatement. This paper relates the theoretical basis for the chemical residence time model as it applies to phosphorus and discusses the limits, capabilities and applications of the model. The model is potentially useful for assessing a variety of lake rehabilitation procedures. Effects of improved waste water treatment may be simulated by reducing the influx concentration and the impact of diversion projects can be estimated by altering both the influx concentration and the volumetric flow rate. (Bell-Cornell)  
W77-00124

**ROLE OF EDDY DIFFUSIVITY IN THERMOCLINE FORMATION,**  
Leicester Univ. (England). Dept. of Engineering.

For primary bibliographic entry see Field 2H.  
W77-00139

**ANALYTICAL SOLUTION FOR 3-D DIFFUSION MODEL,**  
EnviroSphere/EBASCO, New York.  
E. Y. T. Kuo.

Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol. 102, No. EE4, Proceedings Paper 12315, p 805-820, August 1976. 8 fig, 3 ref, 3 append.

Descriptors: \*Diffusion, \*Open channel flow, \*Dispersion, \*Thermal pollution, \*Dye dispersion, Hydraulics, Analytical techniques, Estuaries, Unsteady flow, Methodology, Turbulence, Equations, Mathematical studies.  
Identifiers: \*Constant parameter river, Absorption coefficient.

It is often desirable to estimate the ambient diffusion characteristics in a laterally bounded river and estuary, once discharge loses its momentum to its entrainment mixing processes. Although turbulent diffusions are three-dimensional in nature, the main mean convective transport and the variations of the dispersion characteristics in a river have been assumed to be longitudinal to make the problem tractable. Analytical expressions were derived for solving dye and heat diffusion in the case of their instantaneous as well as continuous release. The analytical solutions were presented for diffusion problems related to a constant parameter river. An application of the solution to a dye data analysis was described. The results indicated general agreement between the data and theoretical prediction despite the many simplifying assumptions made to obtain the analytical solution. (Singh-ISWS)  
W77-00141

**NUMBER, GENERATION TIME AND PRODUCTION OF BACTERIA IN WATER OF THE SARATOV RESERVOIR, (IN RUSSIAN),**  
Akademiya Nauk SSSR, Moscow. Institut Biologii Vnutrennykh Vod.  
For primary bibliographic entry see Field 5C.  
W77-00143

**DISPOSITION OF FERTILIZER NITRATE APPLIED TO A SWELLING CLAY SOIL IN THE FIELD,**  
Texas Agricultural Experiment Station, College Station.  
D. E. Kissel, S. J. Smith, and D. W. Dillow.  
Journal of Environmental Quality, Vol. 5, No. 1, p 66-71, January-March 1976. 4 fig, 3 tab, 19 ref.

Descriptors: \*Nitrogen compounds, \*Nitrates, \*Fertilizers, \*Leaching, \*Soil chemistry, Water quality, Analytical techniques, Leachate, Drainage, Nutrients, Runoff, Subsurface drainage, Water pollution sources, Nutrient removal, Water pollution, Percolation, Infiltration, Lysimeters, Drainage water, Grain sorghum, Root zone, Path of pollutants.  
Identifiers: \*Nitrate leaching, Nitrogen balance, \*Nitrate fertilizer, \*Nitrate-nitrogen, \*Leaching losses, Nitrogen fertilizer efficiency, Nitrogen 15, Field-drainage lysimeters, Total nitrogen, Ammonium-nitrogen.

This study was prompted by the present controversy over the role that N-fertilizer use may have in reducing water quality. The objective was to determine the disposition of N fertilizer (enriched with <sup>15</sup>N) applied to level (less than 2% slope) Houston Black clay near the economic optimum application rate (112 kg N/ha) for grain sorghum. Particular emphasis was placed on determining the amount of applied N which leached below the root zone at different times during and after the growing season. A large, undisturbed field-drainage lysimeter was used to measure leaching of NO<sub>3</sub>(-)-N below the root zone. During

spring 1973, 94 mm of drainage water containing a mean concentration of 2.4 ppm fertilizer-derived NO<sub>3</sub>(-)-N percolated through the soil profile. At crop maturity, only 55% of the N applied the previous spring was recovered by the crop or was present in drainage water. Large amounts of N not recovered by the crop were either measured as immobilized N (20% of the applied N) or were unrecovered and assumed denitrified (17%). During the fall and winter, approximately 120 mm of drainage water containing 0.5 ppm or less fertilizer-derived NO<sub>3</sub>(-)-N percolated through the soil profile. These results indicated that for rainfall conditions observed in this study (minimal crop water deficit), the application of N fertilizer to grain sorghum at the near-optimum economic rate probably would not seriously reduce groundwater quality on a swelling clay soil, even though crop recovery of applied N might be low.  
W77-00144

**NUMERICAL ESTUARINE MODELS FOR WATER QUALITY MANAGEMENT IN THE BLACKSTONE RIVER-PROVIDENCE RIVER AND THE TAUNTON RIVER-MT. HOPE BAY COMPLEXES,**  
Rhode Island Univ., Kingston. Dept. of Mechanical Engineering and Applied Mechanics; and Rhode Island Univ., Kingston. Dept. of Ocean Engineering.  
F. M. White, R. C. Lessman, and M. Spaulding.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-258 775, Price codes: A03 in paper copy, A01 in microfiche. Completion Report, (1976). 30 p, 15 fig, 1 tab, 7 ref. OWRT A-059-RI(1). 14-31-0001-5040.

Descriptors: Water quality, Prediction, \*Model studies, \*Mathematical models, Massachusetts, \*Blackstone River basin(Mass-RI), Rhode Island, Management, Organic wastes, Coliforms, Distribution, Phosphates, Nitrogen, \*Path of pollutants, River basins, Dissolved oxygen, Biochemical oxygen demand.

A one-dimensional numerical finite-difference model is developed for computing water quality parameters in a river basin. The model is then applied to the Blackstone River Basin between Auburn, Massachusetts and Central Falls, Rhode Island. The river is divided into 57 numerical segments of average length 4900 feet and average cross-section 500 square feet. Source loads are given for the various constituent discharges into the river. Computations are made for the distribution of dissolved oxygen, biochemical oxygen demand, total phosphates, ammonia nitrogen, nitrate nitrogen, total alkalinity, and total coliforms, for four different seasonal river volume flow rates. Good agreement is obtained for phosphate, nitrate, coliforms, and dissolved oxygen. Poorer agreement is found for ammonia, alkalinity, and BOD, the probable reason being lack of accurate source data. Some design calculations are shown for the effect of turbulent diffusion rate, decay coefficient, and improved sewage treatment on the distribution of water quality variables in the river.  
W77-00152

**INVESTIGATION OF BACTERIOLOGICAL POLLUTION OF RECREATIONAL WATERS IN ARIZONA,**  
Arizona Univ., Tucson. Dept. of Watershed Management; and Arizona Univ., Tucson. School of Renewable Natural Resources.  
G. S. Lehman, and M. M. Fogel.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-258 779, Price codes: A02 in paper copy, A01 in microfiche. Completion Report, August 1976. 3 p, 3 ref. OWRT A-053-ARIZ(3). 14-34-0001-6003.

Descriptors: \*Water quality standards, \*Arizona, \*Bacteria, \*Recreation, Lakes, Recreational facilities, Swimming, Water sports, \*Bottom sediments, Lake sediments.

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5B—Sources Of Pollution

Identifiers: Recreational waters, \*Bacteriological pollutions, Central Arizona, \*Canyon Lake(Ariz).

Bacterial water quality was studied in a swimming area on Canyon Lake, Arizona. Water quality standards for bacteria were not exceeded early in the season, even when the facility was used at capacity. Some problems were encountered late in the season when the bacteria-laden bottom sediments were agitated by wind and wave action and/or when runoff producing storms occurred. Water currents, possibly unique to the area, provide a cleansing action that limited accumulation of undesirable quantities of bacteria in the water and sediment. Bacteria concentrations in the sediments remained at elevated levels for some time after the swimming season but decreased to the base level by the following spring.  
W77-00153

**AGRICULTURAL RUNOFF AS A SOURCE OF HALOMETHANES IN DRINKING WATER,** Iowa Univ., Iowa City. State Hygienic Lab. R. L. Morris, and L. G. Johnson. American Water Works Association Journal, Vol. 68, No. 9, p 492-494, September 1976. 4 tab, 1 ref.

Descriptors: \*Agricultural runoff, \*Chlorination, \*Disinfection, \*Iowa, \*Water quality, \*Organic compounds, Analytical techniques, Runoff, Agricultural watersheds, Surface runoff, Halogens, Bromine, Chlorine, Turbidity, Gas chromatography, Water treatment, Solvent extractions, Municipal water.  
Identifiers: \*Halomethanes, \*Chlorination products, Farm runoff, Chlorine treatment, Chloroform, Carbontetrachloride, Chlorine demand, Volatile organics, Carcinogenic products, Powdered carbon, Halogenated methanes.

Data on various raw-water sources in Iowa were analyzed in relation to the finished waters produced from them; periods of high agricultural runoff were distinctly associated with peaks in halomethanes. Turbidity removal prior to chlorination was shown to be critical to minimize chloroform production during disinfection. Municipalities may be interested by the inexpensive new methodology developed to test for these substances, a current concern in the water-supply field. (Henley-ISWS)  
W77-00163

**SURFACE RUNOFF LOSSES OF FERTILIZER ELEMENTS,** Louisiana State Univ., Baton Rouge. Dept. of Agronomy, and Louisiana Agricultural Experiment Station, Baton Rouge. E. P. Dunigan, R. A. Phelan, and C. L. Mondart, Jr. Journal of Environmental Quality, Vol. 5, No. 3, p 339-342, 1976. 6 tab, 9 ref.

Descriptors: \*Nitrogen compounds, \*Phosphorus compounds, \*Fertilizers, \*Nutrient removal, \*Agricultural runoff, \*Louisiana, Nitrogen, Ammonia, Nitrates, Phosphates, Potassium compounds, Leaching, Potash, Runoff, Water quality, Water pollution, Analytical techniques, Surface runoff, On-site investigations.  
Identifiers: Fertilizer elements, Surface runoff losses, Fertilizer nutrient losses, Nutrient transport, Nitrogen losses, Loring silt loam, Soluble nutrients, Analytical methods, Nitrogen transport, Phosphorus transport.

Surface runoff losses of fertilizer N, P, and K were measured from a Loring silt loam soil with an average slope of 5%. Plots seeded to pearl millet in 1973 and 1974 were fertilized at the rate of 112-49-93 kg/ha of incorporated N, P, and K using two different fertilizer blends, a 33.3-8.7-16.6 and an 8-3.5-6.6. The percent of water-soluble fertilizer elements lost in 1973 from the higher and lower blend concentrations, respectively, were N, 0.50 and 0.30%; P, 0.14 and 0.06% and K, 0.67 and 0.92%. In

1974, N losses were 0.89 and 0.41%; P, 0.35 and 0.20%; and K, 0.42 and 0.35%. Precipitation during the experimental periods was 20.40 cm in 1973 and 11.03 cm in 1974. Two of the millet plots were then topdressed with  $\text{NH}_4\text{NO}_3$  fertilizer at the rate of 112 kg N/ha. Topdressed fertilizer-N losses were 2.68% in 1973 and 1.82% in 1974. Precipitation during these second tests was 27.97 cm in 1973 and 27.69 cm in 1974. Ryegrass plots were fertilized with sulfur-coated urea (SCU) and uncoated urea (U) at the rate of 224 kg N/ha during the growing seasons of 1973 and 1974. Total N losses (U vs. SCU) were 9.52 and 0.26% in 1973, and 1.67 and 0.42% in 1974. Precipitation was 23.89 cm in 1973 and 29.57 cm in 1974. A 10.08-cm rainfall on the third day of the test in 1973 caused almost three-fourths of the 9.52% N lost from the uncoated urea to be lost in that runoff and while it was still in the urea form. The sulfur coating prevented large surface losses of N from the SCU. (Henley-ISWS)  
W77-00165

**NITROGEN IN SUBSURFACE DISCHARGE FROM AGRICULTURAL WATERSHEDS,** Agricultural Research Service, Columbia, Mo. R. E. Burwell, G. E. Schuman, K. E. Saxton, and H. G. Heinemann. Journal of Environmental Quality, Vol. 5, No. 3, p 325-329, 1976. 4 fig, 3 tab, 15 ref.

Descriptors: \*Nitrogen, \*Subsurface runoff, \*Agricultural watersheds, \*Nutrient removal, \*Nitrogen compounds, \*Iowa, Fertilizers, Leaching, Nutrients, Analytical techniques, Percolation, Water quality, Groundwater, Nitrates, Soil erosion, Water pollution sources, Soil conservation, Runoff, Watersheds(Basins), Conservation, Sediment discharge.  
Identifiers: Nutrient transport, Nitrogen losses, \*Missouri Valley, Nitrogen fertilizers, \*Nutrient loss, Soluble nutrients, Chemical fertilizers, Nitrogen transport, Analytical methods.

The nitrogen in subsurface discharge and surface runoff was measured from four agricultural watersheds on Missouri Valley deep loess near Treynor, Iowa, from April 1969 through March 1974. The data showed that, with the agricultural management practices used on the watersheds, the subsurface discharge of water ranged from 62 to 88% of the average annual stream flow. Nitrate in subsurface discharge accounted for 84 to 95% of the total average annual soluble N discharged in stream flow. A terraced watershed continuously cropped to corn had reduced surface runoff, sheet-rill erosion, and associated nitrate-nitrogen discharge, but had increased subsurface discharge of water and soluble N as compared with two contoured corn watersheds. Nitrogen fertilizer applied at a high rate (448 kg/ha/year) exceeding crop needs on the terraced and contoured corn watersheds, increased five- and threefold the average annual subsurface discharge of  $\text{NO}_3\text{-N}$ , respectively, as compared with a contoured watershed fertilized with N at a normal rate (168 kg/ha/year). Controlling the watershed discharge of N and subsequent pollution of stream flow from the Iowa and Missouri deep loess hills requires N fertilizer application rates that do not exceed crop needs and using conservation practices that minimize soil erosion and deep percolation. (Henley-ISWS)  
W77-00166

**MATHEMATICAL MODEL FOR PREDICTING THE CONSOLIDATION OF DREDGED MATERIAL IN CONFINED DISPOSAL AREAS,** Army Engineer Waterways Experiment Station, Vicksburg, Miss. Soils and Pavements Lab. L. D. Johnson. Available from the National Technical Information Service, Springfield, Va 22161 as ADA-020 949, Price codes: A06 in paper copy, A01 in microfiche. Technical Report D-76-1, January 1976. 110 p, 14 fig, 5 tab, 51 ref, 3 append. DMRP Work Unit 2C08.

Descriptors: \*Consolidation, \*Dredging, \*Floods, Disposal, Flow, Spoil banks, Soil, Mathematical models, Environmental effects, Seepage, Model studies.  
Identifiers: \*Dredged areas, \*Disposal areas, Dredged material, Dredged spoil, Dredged material disposal, Containment areas, Soil permeability, Flow patterns.

A tentative procedure was suggested for the estimation of the volume-time relationships of dredged material in a flooded containment area based on simple sedimentation and consolidation theories. The procedure also included a method to compute the consolidation of the foundation soils by standard consolidation theory. Laboratory and field investigations were necessary to verify and to develop further the equations and procedures obtained during this study for estimating volume changes with time of various types of sediments accommodated in containment areas. These factors were investigated in subsequent Dredged Material Research Program studies in order to develop a complete methodology for determining the capacity of a containment area. (Roberts-ISWS)  
W77-00167

**COMPOSITIONAL CHANGES OF A FUEL OIL FROM AN OIL SPILL DUE TO NATURAL EXPOSURE,** McGill Univ., Montreal (Quebec). Dept. of Civil Engineering and Applied Mechanics. R. N. Young, and A. J. Sethi. Water, Air, and Soil Pollution, Vol. 5, No. 2, p 195-205, 1975. 4 fig., 4 tab., 15 ref.

Descriptors: \*Oil pollution, \*Beaches, \*Weathering, Sands, \*Canada, Analytical techniques, Reduction(Chemical), Soils, Aromatic compounds, Ethers, Oxidation, Water pollution effects, \*Oil spills.  
Identifiers: \*Pearce Island(British Columbia), n-Paraffins, Sulfones.

On January 24, 1973, an ocean freighter carrying heavy fuel oil struck a reef in Queen Charlotte Strait, British Columbia. The resulting oil contamination of beaches on Pearce Island was kept in its original state except for time-lapse natural weathering. Oil was extracted with petroleum ether or carbon disulfide: acetone: methanol; the solvent mixture reduced 4-5 times more oil. Gas liquid chromatography and infrared absorption were used to detect compositional changes. X-ray diffraction studies showed that the soil contained quartz, feldspar (both plagioclase and alkali), plus small amounts of hornblende and kaolinite; extraction of oil enhanced the intensity and sharpness of diffraction patterns. Gas liquid chromatography indicated that low molecular weight n-paraffins were lost during weathering. Aromatics had evaporated after one day of exposure. Infrared studies indicated ethers in all samples except the original oil sample and that sulfoxides had been oxidized to sulfones, due to an oxidation reaction resulting from natural exposure. Low molecular weight n-paraffins were lost through formation of ether and sulfone groups. After a six-month exposure to physical weather stresses up to 4% of the fuel oil spill and washed ashore was still retained in the soil material; about 3.5% remained after a year. (Buchanan-Davidson-Wisconsin).  
W77-00183

**THE INFLUENCE OF HYDROLOGICAL CONDITIONS ON DISSOLVED AND SUSPENDED CONSTITUENTS IN THE MISSOURI RIVER,** Wisconsin Univ., Madison. Lab. of Hygiene. For primary bibliographic entry see Field 5C. W77-00184

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

### Sources Of Pollution—Group 5B

**DEPOSITION OF AIRBORNE MERCURY FROM SIX SWEDISH CHLOR-ALKALI PLANTS SURVEYED BY MOSS ANALYSIS.**  
Swedish Water and Air Pollution Research Lab., Göteborg.  
For primary bibliographic entry see Field 5A.  
W77-00186

**SUBSTITUTE CHEMICAL PROGRAM: INITIAL SCIENTIFIC AND MINIECONOMIC REVIEW OF MALATHION.**  
Midwest Research Inst., Kansas City, Mo.  
For primary bibliographic entry see Field 5C.  
W77-00192

**LOS ANGELES HARBOR FIELD INVESTIGATION OF OIL AND BACKGROUND LUMINESCENCE SIGNATURES.**  
McDonnell Douglas Astronautics Co., Huntington Beach, Calif.  
For primary bibliographic entry see Field 5A.  
W77-00197

**DEVELOPING A TOTAL OIL SPILL CLEANUP CAPABILITY IN THE SAN FRANCISCO BAY AREA.**  
Clean Bay Inc., Concord, Calif.  
For primary bibliographic entry see Field 5G.  
W77-00200

**COAST GUARD TRANSFER MONITORING PROGRAM.**  
Coast Guard, Washington, D. C. Marine Environmental Protection Div.  
J. V. Leotta, and A. J. Taylor.  
In: Prevention and Control of Oil Spills. Proceedings of Joint Conference, Washington, DC, March 13-15, 1973. p. 45-51, 3 tab.

Descriptors: \*Oil spills, \*Oil pollution, \*Monitoring, \*Pollution abatement, Resources development, Water pollution, \*Water quality control, Continental Shelf, Accidents, Personnel management, Washington, Coast Guard Regulations.  
Identifiers: \*Outer Continental Shelf, Petroleum, Puget Sound, Tankers, Loading, Fuel transfers.

Coast Guard monitoring of significant bulk petroleum transfers has a positive effect on the prevention of intentional and accidental discharges. The six month study placed Coast Guard personnel at the site of 90% of the major transfer operations occurring in the Puget Sound area. The monitors observed transfer operations to insure that all applicable regulations were being observed. Coast Guard personnel were able to develop expertise in petroleum transfer techniques and related environmental concerns involving the Coast Guard. The resulting degree of professionalism favorably affected other areas of Coast Guard involvement in water-front activities and provided a closer relationship with industry and a mutual appreciation of responsibilities. A marked decline in unknown source discharges indicated that monitoring was also effective in educating owners and operators of responsibilities in reporting discharges. The major benefit to industry was the assurance that its personnel were observing proper transfer procedures. In addition, training needs were more easily established, and the effectiveness of company training programs evaluated. Finally, employee morale improved with the realization of the importance and responsibility of their jobs. The establishment of a monitoring program nationwide is discussed. Insights gained in the Seattle effort are related to the implementation of an effective discharge prevention program with a minimal burden on industry. (See also W76-09312) (Sinha-OEIS)  
W77-00204

**THE VISIBILITY OF OIL-WATER DISCHARGES.**  
National Environmental Research Center, Edison, N. J. Edison Water Quality Research Div.  
B. Hornstein.

In: Prevention and Control of Oil Spills. Proceedings of Joint Conference, Washington, DC, March 13-15, 1973. p. 91-99, 2 fig, 8 tab, 8 ref.

Descriptors: \*Oil spills, \*Oil pollution, Water pollution, \*Water quality control, \*Monitoring, Discharge measurement, Films, Reflectance. Identifiers: \*Outer continental shelf, \*Visibility, Detection, Oil-water mixtures, Interference color effects, Raritan Bay(NJ).

Controlled oil films from 15 through 3000 nanometers (3 microns) thick show reflectance and interference color effects that vary in an orderly way with film thickness. Visibility of a given film is variable and is affected by ambient factors that include sky conditions, water surface state, and the depth and color of the water. Controlled streams of 25 to 100 gpm, containing 5 to 250 ppm of oil, were discharged into Raritan Bay from a 65-foot vessel. Discharge points were above the surface or 2 to 5 feet below the surface, with the vessel an anchor in tidal currents, simulating a fixed source in a low current. Above-surface discharges were also made with the vessel underway at 6 to 15 knots. The visibility and appearance of films resulting from the discharges were recorded from the vessel and from a helicopter. The visibility of above-surface discharges for all combinations of water rate, oil content, and vessel speed, is correlated by a Specific Oil Rate (SOR) parameter. Results of discharges reported by the Coast Guard for vessel speeds of 10-17 kt and by the British for 8-16 kt correlate with ours via the SOR parameter. These observations were also from aircraft. Sub-surface discharges appeared substantially less visible than corresponding above surface discharges. Replication, however, was insufficient to allow development of a correlation. (See also W76-09312) (Sinha-OEIS)  
W77-00212

**A MULTIPARAMETER OIL POLLUTION SOURCE IDENTIFICATION SYSTEM.**  
Phillips Petroleum Co., Bartlesville, Okla. Research Div.  
For primary bibliographic entry see Field 5A.  
W77-00222

**CHARACTERISTICS OF NATURALLY OCCURRING AND POLLUTANT HYDROCARBONS IN MARINE SEDIMENTS.**  
Paris Univ. (France).  
For primary bibliographic entry see Field 5A.  
W77-00223

**COMPARATIVE IDENTIFICATION OF OIL SPILLS BY FLUORESCENCE SPECTROSCOPY FINGERPRINTING.**  
Environmental Protection Agency, Edison, N. J. Surveillance and Analysis Div.; and Environmental Protection Agency, Edison, N. J. Region II.  
For primary bibliographic entry see Field 5A.  
W77-00224

**DETERMINATION OF HYDROCARBON SOLUBILITY IN SEA WATER AND THE ANALYSIS OF HYDROCARBONS IN WATER-EXTRACTS.**  
National Bureau of Standards, Washington, D. C. Inst. for Materials Research.  
For primary bibliographic entry see Field 5A.  
W77-00225

**LABORATORY AND FIELD TESTING OF SURFACE-FILM FORMING CHEMICALS FOR USE AS OIL COLLECTING AGENTS.**  
Naval Research Lab., Washington, D. C.  
W. R. Barger.

In: Prevention and Control of Oil Spills. Proceedings of Joint Conference, Washington, DC, March 13-15, 1973. p. 241-246, 3 fig, 5 tab, 9 ref.

Descriptors: \*Oil spills, \*Water pollution sources, \*Oil pollution, \*Water quality control, Testing. Identifiers: \*Outer Continental Shelf, \*Oil recovery, Chemical treatment, Surface film, Collecting agents.

Forty-seven commercially available chemicals capable of controlling oil were examined in the laboratory during 1971 to determine which were practical oil collecting agents. A series of screening tests was developed, based upon physical properties and surface-chemical properties. The materials judged to be most useful by these tests are presently being evaluated in multicomponent field tests of oil recovery equipment. Both laboratory and field tests have indicated that such materials can aid in cleaning up spilled oil. (See also W76-09312) (Sinha-OEIS)  
W77-00226

**DEVELOPMENT OF THE 'NEXT GENERATION' CHEMICAL DISPERSANTS.**  
Exxon Research and Engineering Co., Florham Park, N. J.  
For primary bibliographic entry see Field 5G.  
W77-00227

**LARGE-SCALE EXPERIMENTS ON THE SPREADING OF OIL AT SEA AND ITS DISAPPEARANCE BY NATURAL FACTORS.**  
Department of Trade and Industry, Stevenage, (England). Warren Spring Lab.  
For primary bibliographic entry see Field 5G.  
W77-00248

**MEASUREMENT OF EVAPORATION RATES FROM OIL SLICKS ON THE OPEN SEA.**  
California Univ., Santa Barbara. Dept. of Chemical and Nuclear Engineering.  
For primary bibliographic entry see Field 5G.  
W77-00249

**FACTORS GOVERNING THE FATE OF OIL AT SEA; VARIATIONS IN THE AMOUNTS AND TYPES OF DISSOLVED OR DISPERSED MATERIALS DURING THE WEATHERING PROCESS.**  
Exxon Research and Engineering Co., Linden, N. J.  
J. W. Frankenfeld.  
In: Prevention and Control of Oil Spills. Proceedings of Joint Conference, Washington, DC, March 13-15, 1973. p. 485-495, 8 fig, 10 tab, 13 ref.

Descriptors: \*Oil spills, \*Oil pollution, \*Water quality control, \*Environmental effects, \*Dispersion, \*Water pollution sources, \*Weathering, Organic compounds, Oxidation. Identifiers: \*Outer Continental Shelf.

An important part of the weathering process is the dissolution or dispersion of organic compounds in the aqueous phase in contact with the oil slick. Some of the factors influencing the amounts and types of compounds found in the water extracts from several crude and refined oils have been investigated. The most important influences appear to be the characteristics of the original oil and the effects of oxidation. The total soluble oil, as measured by partitioning experiments was 4-20 times that actually found after the system was opened to the atmosphere. After about a week's weathering in laboratory simulators, the dissolved organic contents ranged from 3 ppm for a light fuel oil to about 0.5 ppm for crudes and heavy fuels. The prevalent compounds in the aqueous extracts of a crude and a light fuel oil have been investigated using high resolution mass spectroscopy. These



## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5B—Sources Of Pollution

are mostly medium molecular weight aromatics and oxygenated aromatics. The oxygenates appear to be largely alcohols and ethers possibly produced by light catalyzed oxidation during weathering. (See also W76-09312) (Sinha-OEIS) W77-00250

#### EXPERIMENTAL ECOSYSTEMS TO MEASURE FATE OF OIL SPILLS DISPERSED BY SURFACE ACTIVE PRODUCTS

Institut Français du Pétrole, Rueil-Malmaison (France).

C. R. Gatellier, J. L. Oudin, P. Fusey, J. C.

Lacaze, and M. L. Priou.

In: Prevention and Control of Oil Spills, Proceedings of Joint Conference, Washington, DC, March 13-15, 1973. p 497-504, 4 fig, 3 tab, 13 ref.

Descriptors: \*Oil spills, \*Oil pollution, \*Water pollution, \*Environmental effects, \*Ecosystems, \*Surfactants, \*Biodegradation, \*Toxicity, Dispersion, Sea water, Bacteria, Microbial degradation. Identifiers: \*Outer Continental Shelf, Biological effects, Dispersants, Hydrocarbons.

Efforts to measure the fate of oil dispersed by surface active products are reported. The biological degradation of petroleum, the effect of temperature, the oxygen demand, the part of the dispersant, and the necessity for nutritive elements are discussed. A description is then given of the experimental devices used in these studies. The effect of different products on the microflora of the ecosystems are tabulated. (See also W76-09312) (Sinha-OEIS) W77-00251

#### DISTRIBUTION OF HEAVY HYDROCARBONS IN SOME ATLANTIC OCEAN WATERS

Exxon Research and Engineering Co., Linden, N.J.

R. A. Brown, T. D. Searl, J. J. Elliott, B. G.

Phillips, and D. E. Brandon.

In: Prevention and Control of Oil Spills, Proceedings of Joint Conference, Washington, DC, March 13-15, 1973. p 505-519, 10 fig, 6 tab, 14 ref.

Descriptors: \*Oil spills, \*Oil pollution, \*Water quality control, Water pollution, Atlantic Ocean, Caribbean Sea, Gulf of Mexico, Sea water, Testing, Sampling, \*Path of pollutants. Identifiers: \*Outer Continental Shelf, Hydrocarbons, U.S. East Coast, U.S. Gulf Coast.

During 1971-72 ocean water samples were collected off tankers along two well traveled routes, including: U.S. Gulf Coast to East Coast and Caribbean to East Coast. Approximately 400 samples were taken near the surface and at a depth of about 10 meters. At the time of collection, each sample was extracted with carbon tetrachloride. The extract was subsequently analyzed for hydrocarbon content and, in many cases, the hydrocarbons were characterized as to compound types. Nonvolatile or persistent hydrocarbons were found to be generally in the concentration range of .001 to .012 ppm (wt.). Some variations in the amount and composition were observed according to geographical location of the sample. Sampling and analysis methods are briefly described. The data presented here show that the hydrocarbons in the sea derived from whatever source are extremely low. The data further suggest that the hydrocarbons were derived at least in part from petroleum. There are variations in the amount and composition of the hydrocarbons within the sea water system, and more detailed study may well define the sources and ultimate fate of hydrocarbons in the sea. (See also W76-09312) (Sinha-OEIS) W77-00252

#### PREDICTION OF OIL SLICK MOTIONS IN NARRAGANSETT BAY

Rhode Island Univ., Kingston. Dept. of Mechanical Engineering and Applied Mechanics.

J. Premack, and G. A. Brown.

In: Prevention and Control of Oil Spills, Proceedings of Joint Conference, Washington, DC, March 13-15, 1973. p 531-540, 11 fig, 3 tab, 11 ref.

Descriptors: \*Oil spills, \*Oil pollution, \*Water quality control, Pollution abatement, \*Water pollution, Estuaries, Planning, Rhode Island, \*Path of pollutants.

Identifiers: \*Outer Continental Shelf, Narragansett Bay(RI), Prediction.

A comparison of the calculated size and arrival times for the P.W. Thirtle oil spill with existing data indicate that the oil spill motion simulation can assist the oil contingency planner significantly in estimating the size and arrival times of an oil spill in a tidal estuary. The assumption that a 24,000 barrel spill can be simulated by the independent spreading and drifting of 12 hourly spills, each of 2,000 barrels, is at best a crude one. However, based on the evidence of this particular study it appears to be accurate enough for contingency planning purposes. However, additional analytical work should be done to permit a more physically correct modeling of the process. (See also W76-09312) (Sinha-OEIS) W77-00253

#### THE PHYSICAL OCEANOGRAPHY AND WATER QUALITY OF NEW YORK HARBOR AND WESTERN LONG ISLAND SOUND

State Univ. of New York at Stony Brook. Marine Sciences Research Center.

For primary bibliographic entry see Field 5G.

W77-00273

#### RETENTION OF ARSENIC BY HYDROXY-ALUMINUM ON SURFACES OF MICACEOUS MINERAL COLLOIDS

Saskatchewan Univ., Saskatoon. Dept. of Soil Science.

P. M. Huang.

Soil Science Society of America Proceedings, Vol. 39, No. 2, p 271-274. March-April 1975. 2 fig, 5 tab, 19 ref.

Descriptors: \*Soil chemistry, \*Arsenic compounds, Soil properties, Soil investigations, Soil chemical properties, Colloids, Ions, Geochemistry. Identifiers: \*Arsenic, Biotite, Muscovite, Micaeovs mineral colloids.

This study was carried out to examine the relative significance of as retention by hydroxy-Al on external and interlamellar surfaces of micaceous mineral colloids. Depletion of K from muscovite and biotite decreased as retention. This effect was attributed to the exclusion of arsenate ions by the K-depleted layers. Hydroxy-Al in the interlamellar spaces of vermiculite and K-depleted micas was not found to contribute significantly to as retention in the solution concentration range of 2 to 10 ppm as. (Skogerboe-Colo St) W77-00283

#### VARIATIONS IN THE NATURAL ABUNDANCE OF N OF WHEAT PLANTS IN RELATION TO FERTILIZER NITROGEN APPLICATIONS

Washington Univ., St. Louis, Mo. Center for the Biology of Natural Systems.

For primary bibliographic entry see Field 3F.

W77-00292

#### EFFECT OF ANION EXCLUSION ON THE MOVEMENT OF CHLORIDE THROUGH SOILS

Chile Univ., Santiago. Facultad de Ciencias Químicas.

H. Appelt, K. Holtzclaw, and P. F. Pratt.

Soil Science Society of America Proceedings, Vol. 39, No. 2, p 264-267, March-April 1975. 2 fig, 4 tab, 14 ref.

Descriptors: \*Soil chemistry, \*Chlorides, \*Soil chemical properties, Soil investigations, Soil properties, \*California, \*Cation exchange, Geochemistry. Identifiers: \*Anion exclusion, Chloride movement.

The effects of anion exclusion on the movement of chloride through soils were studied using a variety of subsurface soil samples from southern California. The data reported suggest that the nature of the clay mineral, clay content, saturation percentage and iron oxide content together with the cation-exchange capacity are important soil characteristics related to the volume of exclusion. General equations that are based only on specific charge seem to be oversimplifications. Another serious limitation of general equations obtained under laboratory conditions is their extrapolation to field conditions. The high variability regarding salt distribution commonly found in the field makes the use of correction factors, such as volume of exclusion, of limited value. More studies under field conditions are necessary before quantitative predictions can be made using general equations obtained with disturbed soil samples in the laboratory. (Skogerboe-Colo St) W77-00293

#### DENITRIFICATION RATES IN RELATION TO TOTAL AND EXTRACTABLE SOIL CARBON

Agricultural Research Service, Beltsville, Md.

For primary bibliographic entry see Field 2G.

W77-00294

#### SORPTION OF SULFUR DIOXIDE BY CALCAREOUS SOILS

Arizona Univ., Tucson. Dept. of Soils, Water and Engineering.

M. S. Yee, H. L. Bohn, and S. Miyamoto.

Soil Science Society of America Proceedings, Vol. 39, No. 2, p 268-270. March-April 1975. 5 fig, 3 tab, 14 ref.

Descriptors: \*Sorption, \*Sulfur, \*Sulfur compounds, \*Calcareous soils, Soil chemistry, Soil chemical properties, Pollutants, Soil moisture. Identifiers: \*Sulfur dioxide.

The capacities and rates of calcareous soils to sorb SO<sub>2</sub> were measured by a steady-state method in which a stream of air plus SO<sub>2</sub> passed rapidly through the soil. At room temperature, air-dry calcareous soils were saturated with SO<sub>2</sub> within 10 to 15 min from a dry gas stream. The sorption capacities, 0.4 to 1.6 g of S/100 g of soil at 0.34% SO<sub>2</sub> in air, increased with SO<sub>2</sub> concentration and specific surface of the soils. Moisture in the air and/or soils increased the SO<sub>2</sub> sorption capacities to 0.8 to 6.4 g of S/100 g, approximately equivalent to the acid-titratable basicities, but saturation required several hours. The initial sorption rate ranged from 0.06 to 0.29% S/min in the moist soils. (Skogerboe-Colo St) W77-00295

#### RELATIONSHIPS BETWEEN SORPTION AND DESORPTION OF PHOSPHORUS BY SOILS

International Inst. of Tropical Agriculture, Ibadan (Nigeria).

J. C. Ballaux, and D. E. Peaslee.

Soil Science Society of America Proceedings, Vol. 39, No. 2, p 275-278, March-April 1975. 1 fig, 7 tab, 22 ref.

Descriptors: \*Sorption, \*Phosphorus, \*Soil properties, Soil investigations, Soil chemistry, Soils, \*Kentucky. Identifiers: \*Desorption.

Relationships between the sorption and desorption of P were investigated for five soils ranging in clay content from 16 to 51%. Langmuir adsorption isotherms for some soils were curvilinear when the P concentration in the equilibrium solution was >10 micro-g/ml. To evaluate sorption at higher concentrations of P, values of adsorption maxima (b) and indices of bonding energy (k) were estimated from tangents to six segments of each isotherm. Within each soil, the six pairs of b and k values were related according to the equation  $k = (a/b)(n)$ , where n was a unique characteristic for each soil. (Skogerboe-Colo St)  
W77-00298

**INTERACTION BETWEEN AQUATIC PLANTS AND BED SEDIMENTS IN MERCURY UPTAKE FROM FLOWING WATER.**  
National Research Council of Canada, Ottawa (Ontario). Div. of Biological Sciences.  
For primary bibliographic entry see Field 5C.  
W77-00301

**EFFECT OF ALTERNATE AEROBIC AND ANAEROBIC CONDITIONS ON REDOX POTENTIAL, ORGANIC MATTER DECOMPOSITION AND NITROGEN LOSS IN A FLOODED SOIL.**  
Louisiana State Univ., Baton Rouge. Lab. of Flooded Soils and Sediments.  
K. R. Reddy, and W. H. Patrick, Jr.  
Soil Biology and Biochemistry Vol. 7, No. 2, p 87-94, March 1975. 6 fig, 1 tab, 25 ref.

Descriptors: \*Aerobic conditions, \*Anaerobic conditions, Organic matter, \*Decomposing organic matter, Nitrogen, Nitrates, Denitrification, \*Oxidation reduction potential, Flooding, Saturated soils.  
Identifiers: \*Nitrogen loss(Soils).

The effect of several cycles of varying length of alternate aerobic and anaerobic conditions on redox potential, organic matter decomposition and loss of added and native nitrogen was investigated under laboratory conditions in flooded soil incubated for 128 days. Redox potential decreased rapidly when air was replaced with argon for the short-time cycles, but decreased more slowly where the aerobic period was long enough to permit build-up of nitrate. The minimum redox potential reached during the anaerobic period was generally lower for the longer cycles, but in all cases was low enough for denitrification to occur. Rate of decomposition of organic matter was faster in the treatments with a greater number of alternate aerobic and anaerobic periods. (Skogerboe-Colo St)  
W77-00306

**RELATIONSHIPS BETWEEN THE DENITRIFICATION CAPACITIES OF SOILS AND TOTAL, WATER-SOLUBLE AND READILY DECOMPOSABLE SOIL ORGANIC MATTER.**  
Iowa State Univ., Ames. Dept. of Agronomy.  
For primary bibliographic entry see Field 2G.  
W77-00311

**A SYSTEMATIC PROCEDURE FOR TAXING AGRICULTURAL POLLUTION SOURCES.**  
Colorado State Univ., Fort Collins. Dept. of Agricultural Engineering.  
For primary bibliographic entry see Field 5G.  
W77-00314

**CHLORINATED HYDROCARBON PESTICIDES IN WESTERN NORTH ATLANTIC OCEAN.**  
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.  
R. B. Jonas, and F. K. Pfander.  
Environmental Science and Technology, Vol. 10, No. 8, p 770-773, August, 1976. 2 fig, 1 tab, 12 ref.

Descriptors: \*Chlorinated hydrocarbon pesticides, \*Atlantic Ocean, \*Water pollution, Waste dilution, \*DDE, \*Dieldrin, Aldrin, DDD, DDT, Pesticides, Water pollution sources, Oceans, Halogenated pesticides, Organic pesticides, \*Distribution patterns, Insecticides, Pollutants, \*Path of pollutants.  
Identifiers: \*Lindane(Gamma-hexachlorocyclohexane).

Both 1,1-bis-(p-chlorophenyl)-2,2-dichloroethylene (DDE) and dieldrin (1,2,3,4,10,10-hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-1,4-endo-exo-5,8-dimethano-naphthalene) were detected in the offshore waters of the western North Atlantic Ocean from the surface to 1000 m depth. The mean concentrations of the two pesticides are 3.8 (DDE) and 5.8 (dieldrin) parts per trillion (ng/liter). Other chlorinated pesticides, including lindane, aldrin, 1,1-bis-(p-chlorophenyl)-2,2-dichloroethane (DDD), and DDT, could not be detected at most sample sites by currently available analytical techniques. The data suggest that considerable variability, both with depth and distance from shore, is a dominant feature of the distribution of chlorinated pesticides in the North Atlantic Ocean. Concentrations of DDE and dieldrin range from 0.1 to 18.1 and 0.4 and 19.4 ng/liter, respectively. The observed environmental distribution of these pesticides would be consistent with a hypothesis of uptake and transport of these compounds on particulates in the sea. (Witt-IPC)  
W77-00325

**KLEBSIELLA DENSITIES IN WATERS RECEIVING WOOD PULP EFFLUENTS.**  
Environmental Protection Agency, Dauphin Island, Ala. Gulf Coast Water Supply Research Lab.  
For primary bibliographic entry see Field 5C.  
W77-00337

**ON THE EUTROPHICATION IN THE LAKE CHANGJIA, (IN KOREAN).**  
Seoul National Univ. (Republic of Korea). Dept. of Botany.  
For primary bibliographic entry see Field 5C.  
W77-00344

**THE EFFECT OF SURFACE-ACTIVE SUBSTANCES ON PATHOGENIC ENTEROBACTERIA IN WATER, (IN RUSSIAN).**  
Moskovskii Gosudarstvennyi Meditsinskii Institut (II) (USSR).  
For primary bibliographic entry see Field 5C.  
W77-00346

**THE BEHAVIOR OF PSEUDOMONAS AERUGINOSA IN SURFACE WATER, COOLING WATER AND WASTE WATER, (IN GERMAN).**  
Bonn Univ. (West Germany). Hygiene Institut.  
K. Botzenhart, R. Wolf, and E. Thofner.  
Zentral Bakteriell Parasitenkd Infektionskr Hyg Erste Abt Orig Reihe B Hyg Praev Med 161(1), p 72-83, 1975.

Descriptors: \*Cooling water, Water pollution, Thermal pollution, Sewage, Biological treatment, Pseudomonas, \*Aerobic bacteria, Microorganisms.  
Identifiers: \*Pseudomonas-aeruginosa.

The occurrence and numerical behavior of P. aeruginosa in natural waters with and without waste water contamination, in dams, cooling water circulation systems and cooling water discharge, in clarification plant and supplementary laboratory tests are reported. P. aeruginosa may occur in the natural flora of open waters, but only following the introduction of human sewage. A rapid reduction of the number of P. aeruginosa to low levels generally occurs over periods of several days to several weeks. In the presence of large quantities

of nutrient, multiplication of P. aeruginosa in natural waters is possible. It appears in technical systems such as cooling water circuits and filter plants. P. aeruginosa probably also multiplies in waste water; in the biological aerobic clarification process a reduction occurs. The effect of higher temperature on the survival or multiplication of P. aeruginosa was not confirmed by laboratory experiments.—Copyright 1975, Biological Abstracts, Inc.  
W77-00347

**SEABED DRIFTER MOVEMENT IN SAN DIEGO BAY AND ADJACENT WATERS.**  
Naval Undersea Center, San Diego, Calif.  
R. R. Hammond.  
Available from the National Technical Information Service, Springfield, VA, 22161, as AD-A022 604. Price codes: A04 in paper copy, A01 in microfiche. Report NUC TP 507, February 1976. 55 p, 9 fig, 8 tab, 34 ref, 2 append.

Descriptors: \*Water circulation, \*Path of pollutants, \*Estuaries, \*Harbors, \*California, Tides, Circulation, Bays, Sediment transport, Currents(Water), On-site investigations, Coasts, Shores, Pollution, Water pollution control, Pollution abatement.  
Identifiers: \*San Diego Bay(Calif), Bottom water movement, Seabed drifters, Tidal flushing, Drifters.

Of vital importance in achieving effective control of pollution in estuaries near dense population centers is a detailed knowledge of the water circulation and flushing mechanisms. Although several experimental and hydrodynamic-numeric studies have been made of the San Diego estuarine system, no information existed on net bottom water movement which affects the flushing of solid waste and sediment transport. Since the seabed drifter has been used successfully to provide valuable information in many estuarine and open sea environments, it was selected for use in the San Diego area. Five hundred drifters were released in the bay and adjacent ocean waters to delineate bottom flow patterns. Four significant bottom drift regimes were discussed: off coastal, main bay channel, open bay, and semi-enclosed docking basins. Mean residual bottom drift ranged from 0.17 kilometers per day off the coast to essentially zero in the docking basins. This compared favorably with results of similar studies of other California estuarine systems. Contrary to expectations, off coast drifter results (31% recovery) showed a persistent north moving bottom current with shallow near coast drift distances between 4 and 25 kilometers. In the open bay a reverse trend was observed from the 16% of the drifters recovered. At the head of the estuary, evaporative densification was believed to occur, with the heavier water sinking and moving outward toward the estuary mouth, resulting in an area of opposing bottom water currents. (Sims-ISWS)  
W77-00356

**COLIFORM BACTERIA FROM DIFFUSE SOURCES AS A FACTOR IN ESTUARINE POLLUTION.**  
Smithsonian Institution, Edgewater, Md. Chesapeake Bay Center for Environmental Studies.  
M. A. Faust.  
Water Research, Vol. 10, No. 7, p 619-627, 1976. 3 fig, 5 tab, 35 ref.

Descriptors: Coliforms, \*Bacteria, \*Water pollution sources, \*Estuarine environment, \*E. Coli, \*Chesapeake Bay, Sewage bacteria, Water quality, Estuaries, Pollutants, Runoff, Agricultural runoff, Surface runoff, Watersheds(Basins), Nitrates, Phosphorus, Microorganisms, Livestock, \*Maryland.  
Identifiers: \*Coliform bacteria, \*Estuarine pollution, \*Fecal coliform, \*Diffuse pollution sources, \*Estuarine ecosystems, \*Rhode River(Md), Bacterial pollution, Bacterial analyses, Total

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5B—Sources Of Pollution

phosphorus, Rural watershed, Coliform discharge, Fecal pollution.

The contribution of 849 ha of rural watershed to the fecal coliform (FC) pollution of the Rhode River, a subestuary of Chesapeake Bay with a surface area of 485 ha, was estimated. The watershed with an animal population of 0.6 animal unit/ha discharged between 7,500,000 and 669,000,000 FC/ha-day. The FC discharge rate was seasonal and largely dependent upon the water flow. Total coliform (TC) discharge was influenced by the same factors as the FC discharge. It was calculated that, on the average, less than 1% of FC produced by the animals on the land was washed down by water runoff. Occasionally the FC discharge rate in the runoff reached 4-6% of the FC produced by the animals. Fecal coliforms persisted in the water. The FC numbers were high in the Rhode River close to the discharge points, and further away the FC numbers were diluted by the river volume. It was estimated, using the maximum number of FC in the runoff, that 2600 cu m of well mixed receiving water was needed for every ha of watershed area not to exceed the safe water standards (14 FC MPN/100 ml) for shellfish harvesting. Three factors having a role in FC pollution of an estuarine ecosystem were emphasized as a result of this study: (1) the rural watershed contributed substantial quantities of FC to the estuary; (2) the season of the year may determine the level of pollution entering from rural sources into the estuary; (3) the persistence of bacteria in the estuary may increase the pollution level contributed by the watershed, especially at low water temperatures. (Henley-ISWS)  
W77-00359

**VERTICAL DIFFUSION DRIVEN BY INTERNAL WAVES IN A SILL FIORD.**  
Norges Tekniske Høegskole, Trondheim. River and Harbor Lab.  
For primary bibliographic entry see Field 2L.  
W77-00360

**NITROGEN IN SOIL CORES AND GROUND WATER UNDER ABANDONED CATTLE FEEDLOTS.**  
Agricultural Research Service, Lincoln, Nebr. Animal Waste Management Research Unit.  
L. N. Mielke, and J. R. Ellis.  
Journal of Environmental Quality, Vol. 5, No. 1, p 71-75, January-March 1976. 5 fig, 2 tab, 17 ref.

**Descriptors:** \*Nitrates, \*Nitrogen, \*Feed lots, \*Soil contamination, Water pollution sources, \*Groundwater, Soils, Crops Farm management, Soil chemistry, Cores, Pollutants, Pollutant identification, Agriculture, Farm wastes, Cattle, Livestock, Confinement pens, Wastes.  
**Identifiers:** \*Abandoned feed lots.

Soil core samples from four abandoned beef cattle feedlots were analyzed to determine their chemical and physical characteristics. These cores were compared with those from active upland, intermittently used feedlots, and croplands. The nitrate-nitrogen (NO<sub>3</sub>-N) in the abandoned feedlots averaged 7,200 kg/ha in a 9.1-m soil core, while the active upland, intermittently used feedlot, and cropland averaged 1,800, 2,100, and 570 kg/ha NO<sub>3</sub>-N, respectively. The abandoned feedlot core with the highest NO<sub>3</sub>-N had 18,200 kg/ha in a 9.1-m core. Nitrate-N levels in an abandoned feedlot after 15 years of corn-alfalfa rotation were comparable with cropland cores. Groundwater samples obtained from three of the four abandoned feedlots contained 77.2, 43.7, and 0.6 ppm NO<sub>3</sub>-N. (Sims-ISWS)  
W77-00365

**GEOLOGIC NITROGEN IN PLEISTOCENE LOESS IN NEBRASKA.**  
Nebraska Univ., Lincoln. Dept. of Agronomy.  
J. S. Boyce, J. Muir, A. P. Edwards, E. C. Seim, and R. A. Olson.

Journal of Environmental Quality, Vol. 5, No. 1, p 93-96, January-March 1976. 3 fig, 1 tab, 15 ref.

**Descriptors:** \*Nitrogen, \*Nitrates, \*Soil contamination, \*Nebraska, \*Soils, \*Loess, Fertilization, Fertilizers, Agricultural chemicals, Water pollution, Leaching, Irrigation, Cores, Soil chemical properties, Geology, Limestones, Shales, Groundwater.

Research into the relationship between fertilizer use and water quality in Nebraska has resulted in the discovery of large quantities of geologic nitrate within the deep loess mantle of southwestern and central Nebraska. The NO<sub>3</sub>(-) was first encountered at a depth of about 7 m and continued to an unknown depth in excess of 30 m. Nitrate-N values of 25 to 45 ppm characterized the N zone, but values to 87 ppm have been recorded. The NO<sub>3</sub>(-) existed only under the more level uplands of the region; however, it is on this plain that rapid development of irrigation is taking place, and it has been shown that the NO<sub>3</sub>(-) has been leached from beneath older irrigation sites on the plain. (Sims-ISWS)  
W77-00366

**SIMILARITY OF THE MEAN MOTION OF FLUID PARTICLES DISPERSING IN A NATURAL CHANNEL.**  
Geological Survey of Canada, Ottawa(Ontario).  
T. J. Day, and I. R. Wood.  
Water Resources Research, Vol. 12, No. 4, p 655-666, August 1976. 13 fig, 3 tab, 22 ref.

**Descriptors:** \*Dispersion, \*Flow, \*Turbulence, \*Channel morphology, \*Hydrologic data, Velocity, Methodology, Tracers, Distribution patterns, Statistical methods.  
**Identifiers:** Self-similar process, Concentration-time diagram, Dispersing cloud, Channel geometry.

The longitudinal dispersion in natural river channels was shown to exhibit the characteristics, constant velocity ratios, and similarity in the distribution of physical dimensions of a self-similar process. Although the kinematic relations and the structure of the turbulent field were sensitive to the nature of the flow boundaries and the geometry of the channel, similarity was maintained in flows in a wide range of steep gravel and boulder bed channels. A simple method was developed for predicting the longitudinal pattern of dispersion. It contained three basic hydraulic parameters which could be determined by a field experiment. Data on steep channels and distances up to 1000 channel widths from the dump point were used in developing the method. Though these data were rather limited in scope, the results suggested that the general method may be applicable to streams with a range of characteristics. (Singh-ISWS)  
W77-00371

**MEASUREMENTS OF ESTUARY DISPERSION COEFFICIENTS.**  
Rhodesia Univ., Salisbury. Dept. of Civil Engineering.  
P. R. B. Ward.  
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol. 102, No. EE4, Technical Note, p 855-860, August 1976. 1 fig, 1 tab, 10 ref, 2 append.

**Descriptors:** \*Dispersion, \*Rhodamine, \*Estuaries, \*Saline water intrusion, \*Tidal effects, On-site tests, Dye dispersion, Velocity, Equations, Travel time, Sampling, \*Path of pollutants, \*Canada.  
**Identifiers:** \*British Columbia, \*Fraser estuary(BC), Tidal flow.

Measurements of the dispersion of dye clouds from point sources were made in the Fraser estuary located in British Columbia. This estuary is typ-

ical of several large estuaries in that area, and it is characterized by conditions of large tidal range and large freshwater discharge. A salt water wedge penetrates the estuary for several miles during flood tidal flows, provided the freshwater discharge is not close to its maximum. On-site experiments were conducted to ascertain the dispersion characteristics of dye clouds for the following conditions: (1) small river discharge and large tidal flow seawards, and (2) medium river discharge and small tidal flow seawards. The values of the dimensionless transverse dispersion coefficients determined from these experiments were within the range of values measured in laboratory experiments for tidal flows in meandering channels. The transverse mixing was not nearly completed in the duration of the experiment, and the dispersion of the dye cloud was not affected by zones of low velocity near the edges of the channel. (Singh-ISWS)  
W77-00381

**SODIUM CARBONATE IN GROUND WATERS OF THE TURKMEN SSR, (IN RUSSIAN).**  
For primary bibliographic entry see Field 3C.  
W77-00384

**GEOGRAPHICAL AND SEASONAL VARIABILITY OF MARINE PLANKTON.**  
Akademiya Nauk SSSR, Leningrad. Zoologicheskii Institut.  
For primary bibliographic entry see Field 5C.  
W77-00393

**ZOOPLANKTON OF DIKSON BAY (KARA SEA).**  
Akademiya Nauk SSSR, Leningrad. Zoologicheskii Institut.  
For primary bibliographic entry see Field 5C.  
W77-00395

**MANGANESE IN FRESH WATERS, (IN RUSSIAN).**  
Akademiya Nauk URSS, Kiev. Institut Hidrobiologii.  
For primary bibliographic entry see Field 5A.  
W77-00405

**HYDROGEOCHEMICAL INVESTIGATION OF THE DANUBE WATER IN AUSTRIA DURING THE YEARS 1971 AND 1972, (IN GERMAN).**  
Bundesversuchs- und Forschungsanstalt Arsenal, Vienna (Austria).  
For primary bibliographic entry see Field 5A.  
W77-00406

**THE IMPORTANCE OF BACTERIOLOGICAL INVESTIGATIONS FOR THE CLASSIFICATION OF FLOWING WATER BODIES, DEMONSTRATED ON THE AUSTRIAN PART OF THE DANUBE, (IN GERMAN).**  
Bundesanstalt fuer Wasserguete, Vienna (Austria).  
For primary bibliographic entry see Field 5A.  
W77-00407

**EVENTS IN THE DJERDAP RESERVOIR IMMEDIATELY AFTER IMPOUNDMENT, (IN GERMAN).**  
Institute for Biological Research, Belgrade (Yugoslavia).  
For primary bibliographic entry see Field 2H.  
W77-00409

**INTRODUCTION TO THE KNOWLEDGE OF FRESHWATER INVERTEBRATES AND THEIR ENVIRONMENT, (IN DUTCH).**  
Rijksinstituut voor Natuurbeheer, Leersun (Netherlands).  
For primary bibliographic entry see Field 2I.  
W77-00410



# TRANSPORT OF CARBON14-ASSIMILATES IN THE SUGAR BEET UNDER DIFFERENT CONDITIONS OF NUTRITION AND MOISTURE, (IN RUSSIAN),

Kirgiz State Univ., Frunze (USSR).

V. A. Pechenov.

Fiziol Biokhim Kul't Rast. 7(3), p 286-290, 1975.

Descriptors: \*Sugar beets, \*Productivity, \*Soil moisture, \*Nutrient requirements, Nitrogen, Potassium, Phosphorus, Path of pollutants, Radioactivity.  
Identifiers: \*Carbon-14.

Total radioactivity of all organs in sugar beet which were given N, P and K was sometimes as high as that in the plants which were not given the minerals. The outflow rate of assimilates increased with the age of plants and particularly in the period intensive accumulation of sugar. Optimization of soil moisture conditions favored a considerable intensification of the assimilate transport into the storage organs. Conditions of mineral nutrition and soil moisture changed the direction of labeled C incorporation into different fractions of organic substances. With rational treatment and optimization of the water regime, the outflow of assimilates into the root crop intensified, the percentage of <sup>14</sup>C incorporation into sugars increased and the yield of sugar per unit of the sowing area increased.—Copyright 1976, Biological Abstracts, Inc.

W77-00421

# TRACE-METAL LEVELS IN THE WATERS AND SEDIMENTS OF CORIO BAY (AUSTRALIA),

Melbourne Univ., Parkville (Australia). School of Chemistry.

For primary bibliographic entry see Field 5A.

W77-00446

# HYGIENIC ASPECTS OF MICROBIAL CONTAMINATION OF WATER BASINS, (IN RUSSIAN),

Institute of General and Municipal Hygiene, Moscow (USSR).

T. A. Nikolaeva, G. A. Bagdasar'yan, A. I.

Iiskova, and Y. G. Talaeva.

Vestn Akad Med Nauk SSR 3, p 46-52, 1975.

Descriptors: \*Microbial degradation, Recreation, \*Self-purification, Basins, \*Bacteria, \*Viruses, Water pollution, Public health, \*Human diseases.

Increasing microbial contamination of water basins, its causes and its role in spreading bacterial and viral intestinal diseases are discussed. The significance of microbial contamination in direct short or long term recreational contact of the population with water of basins is shown; development of recreation institutions for long-term rest near water basins is discussed. Self-cleaning of water basins (microbial, chemical and thermal pollution, correlation between health-important microflora, pathogenic enterobacteria and viruses) is elucidated. The barrier role of existing water-pipe systems with respect to chemical pollutants and pathogenic microflora is discussed. Tasks facing hygienists under conditions of increasing microbial contamination of water basins are stated.—Copyright 1976, Biological Abstracts, Inc.

W77-00454

# IDENTIFICATION AND ANALYSIS OF ORGANIC POLLUTANTS IN WATER.

Environmental Protection Agency, Athens, Ga. Southeast Environmental Research Lab.

For primary bibliographic entry see Field 5A.

W77-00455

# FATE OF SELECTED ORGANIC COMPOUNDS IN THE DISCHARGE OF KRAFT PAPER MILLS INTO LAKE SUPERIOR,

Canada Centre for Inland Waters, Burlington, (Ontario).

M. E. Fox.

In: Identification and Analysis of Organic Pollutants in Water (Keith, L. H., editor), Ann Arbor Science Publishers, Ann Arbor, Michigan, p 641-659, 1976. 7 fig, 9 tab, 7 ref.

Descriptors: \*Pulp wastes, \*Lake Superior, \*Organic compounds, Wastes, Industrial wastes, Water pollution sources, Biota, Fish, Water pollution effects, Pollutants, Water pollution, Lake sediments, Waste dilution, Sediments, Persistence, \*Path of pollutants, \*Canada.  
Identifiers: Nipigon Bay, Nipigon Strait, Kraft mills, Dehydroabietic acid, Resin acids.

Of the 35 identified organic compounds which are dispersed by the effluent plume of a kraft bleached pulp mill into Nipigon Bay, only dehydroabietic acid persisted in the water column. Whether the detected concentrations could cause sublethal effects in lake biota, such as fish tainting, is unknown. Dissipation of organics by dilution with receiving waters appears to be the principal short-term mechanism. Surface sediments contained elevated dehydroabietic acid levels, clearly originating from the discharge. The movement of this material follows the deep channel toward Nipigon Strait and was measured at almost 10 times the Bay's background level at a distance of 15 km from the effluent discharge. (See also W77-00455) (Brown-IPC)

W77-00457

# PERSISTENT ORGANIC COMPOUNDS FROM A PULP MILL IN A NEAR-SHORE FRESH-WATER ENVIRONMENT,

Canada Centre for Inland Waters, Burlington, (Ontario).

B. Brownlee, and W. M. J. Strachan.

In: Identification and Analysis of Organic Pollutants in Water (Keith, L. H., editor), Ann Arbor Science Publishers, Ann Arbor, Michigan, p 661-670, 1976. 1 fig, 3 tab, 6 ref.

Descriptors: \*Pulp wastes, \*Organic compounds, \*Lake Superior, Wastes, Waste dilution, Industrial wastes, Water pollution sources, Great Lakes, Lake Sediments, Organic wastes, Water pollution, freshwater, Discharge(Water), Effluents, Organic acids, Persistence, Sediments, \*Path of pollutants, \*Canada.  
Identifiers: Nipigon Bay, Dehydroabietic acid, 7-keto-dehydroabietic acid, Palmitic acid, Dioctyl phthalate, Acetovanillone, Sandaracopimaric acid, Kraft mills, Resin acids, Fatty acids.

A 25 sq km section of Nipigon Bay on the North shore of Lake Superior was sampled for organic compounds which could have entered the receiving waters from a kraft mill discharge site. Tentative conclusions reached from the findings are as follows: The effluent is a significant source of dehydroabietic acid, some of which enters the bay in particulate form; this acid is quite persistent in the water column, being found in surface sediments in significant amounts 1 km from the plume outfall. Likewise persistent were palmitic acid and dioctyl phthalate. Moderately or slightly persistent were acetovanillone, sandaracopimaric acid, and 7-keto-dehydroabietic acid. (See also W77-00455) (Brown-IPC)

W77-00458

# NATIONAL CONFERENCE ON POLYCHLORINATED BIPHENYLS (NOVEMBER 19-21, 1975, CHICAGO, ILLINOIS), PROCEEDINGS.

Environmental Protection Agency, Washington, D. C. Office of Toxic Substances. Rept. No. EPA-560/6-75-004, 471 p, March, 1976.

Descriptors: \*Polychlorinated biphenyls, \*Conferences, \*Water pollution sources, \*Toxicity, Analysis, Ecology, Economics, Control, Pathology, Biology, Pollutants, Industrial wastes, Wastes, \*Pollutant identification, Water pollution control, Aromatic compounds, Organic compounds, Chemical wastes, \*Toxicity.

The conference was organized into 8 sessions, including a summary session of the other 7, which dealt with various aspects (pathobiology, toxicology, sources, identification, analysis, ecology, economics, chemical substitutes, and control) of polychlorinated biphenyls, as well as with the viewpoints of various interested parties (government, industry, and private citizens). (See W77-00461 thru W77-00462) (Brown-IPC)

W77-00460

# THE VIEW OF THE PAPER INDUSTRY ON THE OCCURRENCE OF PCB'S IN THE ENVIRONMENT AND THE NEED FOR REGULATION,

Container Corp. of America, Carol Stream, Ill. P. E. Trout.

In: National Conference on Polychlorinated Biphenyls, November 19-21, 1975, Chicago, Illinois, U.S. Environmental Protection Agency, Office of Toxic Substances (Washington, D.C. 20460), Report No. EPA-560/6-75-004, p 359-361, March 1976. 3 ref.

Descriptors: \*Pulp and paper industry, \*Polychlorinated biphenyls, \*Aroclors, \*Water pollution sources, \*Legislation, Environment, Pollutants, Wastes, Industrial wastes, Chemical wastes, Organic compounds, Aromatic compounds, Chemicals, Regulation, Toxicity, Persistence, Costs.

On behalf of the American Paper Institute and the Container Corporation of America, the author put forth and justified the following 4 statements: The paper industry does not use or introduce polychlorinated biphenyls (PCB's) into the environment but rather recirculates those already present which are unavoidably included in its manufacturing output. The PCB recirculated by the paper industry (Aroclor 1242) is not found to accumulate in animals, man, or the environment. Current levels of dietary intake are many orders of magnitude lower than the daily intake allowable according to the Food and Drug Administration. Any additional regulatory controls should aim at maximum environmental cost effectiveness. (See also W77-00460) (Brown-IPC)

W77-00461

# STATEMENT RELATING TO POLYCHLORINATED BIPHENYLS ON BEHALF OF THE WISCONSIN PAPER COUNCIL,

Bergstrom Paper Co., Neenah, Wis.

J. S. Haney.

In: National Conference on Polychlorinated Biphenyls, November 19-21, 1975, Chicago, Illinois, U.S. Environmental Protection Agency, Office of Toxic Substances, (Washington, D.C. 20460), Report No. EPA-560/6-75-004, p 362-364, March 1976.

Descriptors: \*Polychlorinated biphenyls, \*Aroclors, \*Pulp and paper industry, \*Legislation, Biodegradation, Pollutants, Wastes, Industrial wastes, Water pollution sources, Recycling, Organic compounds, Aromatic compounds, Chemical wastes, Toxicity, Persistence, Wisconsin. Identifiers: \*Wisconsin Paper Council, Carbonless paper(No-carbon copying paper), Waste paper, Copying paper.

Only a small fraction of domestically produced polychlorinated biphenyls (PCB's) has been used in making carbonless copying paper. The Aroclors involved are less stable, less persistent, less susceptible to accumulation in fish, and more biodegradable than their more highly chlorinated

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5B—Sources Of Pollution

relatives. The impact of the waste paper recycling industry on the PCB issue should be put into a more positive perspective. PCB's cannot be legislated out of paper-recycling systems. Proposed regulations should be realistic, reasonable, feasible, and responsible. (See also W77-00460) (Brown-IPC)  
W77-00462

**REVIEW OF PCB (POLYCHLORINATED BIPHENYLS) IN THE ENVIRONMENT.**  
Environmental Protection Agency, Washington, D.C. Office of Toxic Substances.  
Report No. EPA-560/7-76-001, 141 p, January 1976.

Descriptors: \*Public health, \*Polychlorinated biphenyls, \*Water pollution sources, \*Environment, Lakes, Rivers, Pollutants, Industrial wastes, Cities, Foods, Human population, Monitoring, Pollutant identification, Surveys, Inspection, United States, Data collections.

The data presented have been compiled from national and local monitoring programs and show trends of PCB levels in lake, river, and marine environments, industrial plants, cities, foods, and humans. (Brown-IPC)  
W77-00463

**THE EFFECT OF SOIL PROPERTIES ON ZINC ADSORPTION BY SOILS.**  
Georgia Univ., Experiment. Dept. of Agronomy.  
For primary bibliographic entry see Field 2G.  
W77-00469

**INTERACTIONS BETWEEN ORGANIC COMPOUNDS, MINERALS, AND IONS IN VOLCANIC ASH DERIVED SOILS: I. ADSORPTION OF BENZOATE, P-OH BENZOATE, SALICYLATE, AND PHTHALATE IONS.**  
California Univ., Riverside. Dept. of Soil Science.  
For primary bibliographic entry see Field 2G.  
W77-00473

**INTERACTIONS BETWEEN ORGANIC COMPOUNDS, MINERALS, AND IONS IN VOLCANIC-ASH-DERIVED SOILS: II. EFFECTS OF ORGANIC COMPOUNDS ON THE ADSORPTION OF PHOSPHATE.**  
California Univ., Riverside. Dept. of Soil Science.  
For primary bibliographic entry see Field 2G.  
W77-00474

**EFFECT OF AGRICULTURAL DRAINAGE ON WATER QUALITY.**  
Virginia Polytechnic Inst. and State Univ., Blacksburg. Southern Piedmont Center.  
M. D. Smolen, M. Rasnake, and V. O. Shanholtz.  
Presented at the 1975 Winter Meeting of the American Society of Agricultural Engineers, 9 pages, December 15-18, 1975. Chicago, Illinois. 5 fig., 4 ref. OWRT A-058-VA(1).

Descriptors: \*Return flow, \*Drainage, Water quality, Water pollution control, Model studies, Water chemistry, Nitrogen, Nitrates, Irrigation effects, \*Path of pollutants, Monitoring.  
Identifiers: Nitrate-nitrogen.

Presentation of preliminary results from a modeling and monitoring study which compares chemical quality data from adjacent agricultural and non-agricultural areas. Increased levels of nitrate-nitrogen were detected in field draining streams following the first period of agricultural activity. Results are discussed in terms of a planned comprehensive chemical transport study. (Skogerboe-Colo St)  
W77-00475

**VARIATIONS IN PICLORAM LEACHING PATTERNS FOR SEVERAL SOILS.**  
Washington State Univ., Pullman. Dept. of Agronomy and Soils.  
For primary bibliographic entry see Field 2G.  
W77-00476

**NITRATE REDUCTION AND NITRITE UTILIZATION BY NITRIFIERS IN AN UNSATURATED HANFORD SANDY LOAM.**  
California Univ., Berkeley. Dept. of Soils and Plant Nutrition.  
M. G. Volz, L. W. Belser, M. S. Ardakani, and A. D. McLaren.  
Journal of Environmental Quality, Vol. 4, No. 2, p 179-182, April-June 1975. 2 fig., 2 tab., 20 ref.

Descriptors: \*Nitrates, \*Nitrites, \*Soil investigations, \*Nitrification, Soil environment, Soil management, Agriculture, Soils, Loam, Microbiology, California, Soil analysis, Path of pollutants, Water pollution control.  
Identifiers: \*Microbial ecology.

In order to discern any relationship between added nitrate and microbial growth in a field plot, a Hanford sandy loam was infiltrated for 5 weeks at a rate of 5 cm/day with a solution containing 100 ppm-N and 1.25 mg/liter Cl(-) KNO(3) and CaCl(2) respectively. Nitrate -N, NO(2)(-)-N and Cl(-) concentrations in soils solution were determined and corresponding counts of nitrate reducers, denitrifiers, and NH(4)(+)- and NO(2)(-)-oxidizer populations were made. Ratios of measured to applied concentrations for both NO(3)(-)-N and Cl(-) were nearly identical in all solution samples taken from the unsaturated soil profile, i.e., nitrate reduction was not pronounced and NO(2)(-)-N was less than 1 ppm. (Skogerboe-Colorado State)  
W77-00478

**GROUND-WATER QUALITY IN THE DAVIE LANDFILL, BROWARD COUNTY, FLORIDA.**  
Geological Survey, Tallahassee, Fla.  
H. C. Matraw, Jr.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-256 522, Price codes: A03 in paper copy, A01 in microfiche. Water-Resources Investigations 76-56, June 1976. 29 p, 7 fig., 11 tab., 4 ref.

Descriptors: \*Water pollution sources, \*Path of pollutants, \*Groundwater movement, \*Waste disposal, Septic tanks, Sewage lagoons, Landfills, Oil, Incineration, Water quality, Chemical analysis, Bacteria, Nitrogen, Sodium, Aquifers, \*Florida, Pollutant identification, Coliforms.  
Identifiers: \*Broward County(Fla).

Ground-water adjacent to a disposal pond for septic tank sludge, oil, and grease at the Davie landfill, Broward County, Florida was tested for a variety of ground-water contaminants. Three wells adjacent to the disposal pond yielded water rich in nutrients, organic carbon and many other chemical constituents. Total coliform bacteria ranged from less than 100 to 660 colonies per 100 milliliters in samples collected from the shallowest well (depth 20 feet). At well depths of 35 and 45 feet bacterial counts were less than 20 colonies per 100 milliliters or zero. Concentrations of several constituents in water samples collected from the wells downgradient from the landfill, disposal pond, and an incinerator wash pond were greater than in samples collected from wells immediately upgradient of the landfill. A comparison of sodium-chloride ion ratios indicated that downgradient ground-water contamination was related to the incinerator wash water pond rather than the septic tank sludge pond. (Woodard-USGS)  
W77-00486

**MODELING OF THE TRANSFORMATION OF NITROGEN COMPOUNDS IN A CLOSED**

**AQUATIC MICROSYSTEM, (IN RUSSIAN).**  
A. V. Leonov, and T. A. Aizatullin.  
Ekologiya. 6(2), p 5-10, 1975.

Descriptors: \*Mathematical models, \*Ecosystems, Aquatic environment, \*Nitrogen compounds, Chemical degradation, Lakes, Waste water treatment, Ecological distribution, \*Path of pollutants, Organic compounds.  
Identifiers: \*Heterotrophs, \*Chemoautotrophs.

A mathematical model of a closed chemical-ecological microsystem responsible for transformation of N compounds in an aquatic environment is presented. The model reflects the dynamics of heterotrophs, chemoautotrophs, N-containing compounds, NH<sub>3</sub>, NO<sub>2</sub>, NO<sub>3</sub> and O<sub>2</sub>. The model satisfactorily describes experimental data on the dynamics of the system's components in lake and wastewaters. It can serve as the basis for a model of a real ecological macrosystem.—Copyright 1976, Biological Abstracts, Inc.  
W77-00494

**DISTRIBUTION OF BENTHONIC FORAMINIFERS OFF THE WESTERN COAST OF SOUTH AMERICA, (IN RUSSIAN).**  
Akademiya Nauk SSSR, Moscow. Institut Okeanologii.  
For primary bibliographic entry see Field 2L.  
W77-00496

### 5C. Effects Of Pollution

**ENVIRONMENTAL IMPACT OF CADMIUM AND OTHER HEAVY METALS FROM LAND-APPLIED SEWAGE SLUDGE.**  
Wisconsin Univ., Madison. Dept. of Soil Science.  
D. R. Keeney.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-258 643, Price codes: A03 in paper copy, A01 in microfiche. Wisconsin Water Resources Center, Madison, Technical Report WIS WRC-76-03, July, 1976. 31 p, 11 tab., 29 ref. OWRT A-065-WIS(1). 14-31-0001-5050, 14-34-0001-6052.

Descriptors: Metals, \*Public health, \*Toxicity, \*Sludge disposal, \*Municipal wastes, \*Soil contamination, Chemical properties, \*Wisconsin, \*Heavy metals, \*Cadmium, Environmental effects, Sewage sludge, Soil profiles.  
Identifiers: \*Cascos(Wis), \*Monroe(Wis), \*Beloit(Wis), \*Chippewa Falls(Wis), Janesville(Wis).

Median Cd concentration in fertilizers (primarily P-containing materials) was about the same as in wastewater sludges in Wisconsin. The estimated Cd addition to soils from fertilizers was 2,150 kg, while sludges could add about 1,700 kg Cd if all sludges were land-applied. However, due to differences in the rate of application of these Cd sources, sludge disposal on land could result in a much higher Cd concentration in the soil. A survey of 5 municipalities where sludge has been applied to soil showed that, in general, little metal accumulation in the soil or crops resulted from sludge application. However, metal concentrations of the sludges from the municipalities were generally low compared to sludge from municipalities with heavy industry. High metal accumulations in the turf in a park and golf course were found in areas where sludge had been applied recently. High metal concentrations were also noted in the soil profile in an area where dewatered sludge had been stockpiled for 2 years. Intensive sampling was conducted at one site where records on the rate of sludge addition for 5 consecutive years were available. Results indicate significant increases above background in DTPA-extractable metals but little leaching of the metals, even though the soil was sandy. Statistical analysis of the sample variability showed that the results were

quite variable and that a large number of replicate field samples are needed to obtain valid results.  
W77-00002

#### CAPACITY OF A SPARTINA SALT MARSH TO ASSIMILATE NITROGEN FROM SECONDARILY TREATED SEWAGE

Georgia Univ., Sapelo Island. Marine Inst.  
For primary bibliographic entry see Field 5B.  
W77-00003

#### THE EFFECTS OF VARIOUS TERTIARY TREATMENT NUTRIENT REMOVAL SCHEMES ON PERIPHYTON COMMUNITIES IN MODEL LABORATORY STREAMS

Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.  
J. C. Smrcek, P. H. King, J. Cairns, Jr., K. L. Dickson, and C. W. Randall.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-259 010. Price codes: A07 in paper copy, A01 in microfiche. Virginia Water Resources Research Center, Blacksburg, Bulletin 86, (VPI-VWRRC-BULL. 86), July 1976. 124 p., 18 fig., 54 tab., 180 ref., append. OWRT B-039-VA(2).

Descriptors: \*Eutrophication, \*Periphyton, \*Tertiary treatment, \*Nutrient removal, Water pollution effects, Algae, Pigments, Biomass, Primary productivity, \*Phosphorus, Algal control, Waste water treatment.  
Identifiers: Model stream systems.

A model stream system was established to study the effects upon periphyton communities of effluents from conventional or up-to-date tertiary treatment processes for nutrient(s) removal. Algal phytoplankton, dry weight biomass, organic weight biomass, pigment diversity ratios, and primary productivity of these communities were studied during six different experiments. Laboratory scale treatment systems for ferric chloride coagulation, flocculation and dual media filtration processes were used in the phosphorus removal experiment and in the carbon and phosphorus experiment. Breakpoint chlorination was used in the nitrogen removal experiment. A combination of all the above processes was used in the carbon, nitrogen, and phosphorus removal experiment. Symptoms of enrichment and cultural eutrophication, as indicated by substantial increases in the above biological parameters, were noted during the six experiments. In most cases, the differences in these values between control and experimental model streams were statistically significant. Single nutrient removal caused greater increases in these parameters than double or triple removal methods. Nutrient limitation probably did not occur in any of the experiments because of nutrients in the tertiary effluents. Also, nutrient uptake by the periphyton of phosphate, nitrate nitrogen, and ammonia nitrogen occurred. Phosphorus fixation and utilization by the periphyton was noted. Based on these results, phosphorus was probably not deficient in the model streams during any of the experiments. Eutrophication problems similar to those noted in the present study may occur in natural streams and rivers near discharges from tertiary treatment plant facilities. However, provided the receiving aquatic ecosystem is sufficiently 'healthy' or ecologically diverse, grazing stream herbivores may effectively limit the increase in algal biomass.  
W77-00005

#### NITROGEN EXCRETION BY NITROGEN FIXING BLUE-GREEN ALGAE: III. UTILIZATION OF THE EXCRETED NITROGEN BY GREEN ALGAE, (IN GERMAN)

Kiel Univ. (West Germany). Institut fuer Pharmakognosie.  
P. Pohl, and G. Drath.  
Z. Naturforsch. Sect. C Biosci. 30(2), p 223-226, 1975.

Descriptors: \*Chlorophyta, Nitrogen fixation, \*Cyanophyta, \*Algae, Anabaena, Absorption, \*Nutrients, \*Nitrogen.  
Identifiers: Anabaena-cylindrica, Anabaena-solitaria, Chlorella-vulgaris, Chlorhormidium spp., Scenedesmus-obliquus, Ulothrix-subtilissima, Uronema-barlowi, \*Nitrogen fixing alga(Blue-green).

The total combined N (850 micro-mol N/l) excreted by the N fixing blue-green alga, Anabaena cylindrica, during growth in an artificial nutrient medium, was subsequently utilized to a different degree by various green algae (Chlorella vulgaris, Scenedesmus obliquus, Ulothrix subtilissima, Uronema barlowi, Chlorhormidium spp.). Two species of filamentous green algae, Chlorhormidium sp. (strain I) and Chlorhormidium sp. (strain II), proved to be most suitable. When grown in the above N-enriched medium after removal of A. cylindrica, they lowered the N level in the medium from 850 to 460-600 micro-mol N/l within 29 days. When another N fixing blue-green alga, A. solitaria, was grown under unsterile conditions in mixtures of freshwater and seawater with trace elements (Fe, Mn and Mo) added, N levels of 1000-1060 micro-mol N/l were obtained. These levels were subsequently lowered to 530-570 micro-mol N/l by the 2 spp. of Chlorhormidium. Under appropriate growth conditions, the combined N excreted by A. solitaria can possibly be utilized as a N source for green algae.—Copyright 1975, Biological Abstracts, Inc.  
W77-00006

#### BEHAVIOR OF MERCURY IN SUSPENDED SOLIDS AND BOTTOM SEDIMENTS

Tennessee Technological Univ., Cookeville. Dept. of Civil Engineering.  
W. P. Bonner, and R. B. Bustamante.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-258 663. Price codes: A06 in paper copy, A01 in microfiche. Research Report No. 50, July 26, 1976. 118 p., 36 fig., 14 tab., 74 ref. OWRT A-027-TENN(1). 14-31-0001-5043.

Descriptors: \*Mercury, Water pollution, Sediments, Heavy metals, \*Suspended solids, Pollution control, Toxicity, \*Bottom sediments, Aquatic environment, Absorption, Organic matter, Food chains, Path of pollutants.  
Identifiers: \*Mercury compounds, Mercuric chloride, Mercuric sulfide, Metallic mercury, Phenyl mercuric acetate, Selenium.

Laboratory studies were conducted to show several relationships between selected components of an aquatic environment containing mercury. The data show that mercury as mercuric chloride, mercuric sulfide, phenyl mercuric acetate and metallic mercury becomes associated with sediments very rapidly and with time natural mechanisms in the sediments tend to stabilize or bind the mercury and make it less available to the aquatic environment. Organic components of the water-sediment system play an important role in binding mercuric mercury. Experimental fish show an increase in both the rate of uptake and elimination with increasing temperature between 9 and 30C. Inorganic forms of selenium and mercury are antagonistic toward the toxicity of each other. Collectively, temperature and the presence of naturally occurring organic materials and antagonistic agents could significantly reduce the possibility of mercury accumulation in a food chain leading to man.  
W77-00007

#### PLANT UPTAKE OF HEAVY METALS FROM SEWAGE SLUDGE APPLIED TO LAND

Department of Agriculture, Beltsville, Md.  
For primary bibliographic entry see Field 5D.  
W77-00028

#### EFFECTS OF SEWAGE SLUDGE OR EFFLUENT APPLICATION TO SOIL ON THE MOVEMENT OF NITROGEN, PHOSPHORUS, SOLUBLE SALTS AND TRACE ELEMENTS TO GROUNDWATERS

California Univ., Riverside. Dept. of Soil Science and Agricultural Engineering.  
A. L. Page, and P. F. Pratt.

In: Proceedings of the 1975 National Conference on Municipal Sludge Management and Disposal, August 18-20, 1975, Anaheim, California, p 179-187. 1 fig., 38 ref.

Descriptors: \*Pollutant identification, \*Sewage sludge, \*Effluents, \*Land use, \*Soil water movement, Soil types, Nitrogen, Phosphorus, Salts, Trace elements, Groundwater.

The movement of nitrogen, soluble salts, phosphorus, and trace elements through soils is discussed in terms of the chemistry of these individual constituents and in relation to low and high rate applications of sludges and effluents and soil properties. When considering the movement of these substances through soils, it is important to distinguish between low rates consistent with utilization for crop production and high rates that might be used for disposal of sludges and effluents or for groundwater recharge using reclaimed waters. At low rates of 3 to 5 tons dry solids per acre per yr to supply the phosphorus needs of crops or 10 to 25 dry tons per acre per yr to supply their nitrogen needs, downward movement of phosphorus and most trace elements is nil or very slow. Soluble salts and nitrate move with drainage waters. At rates of 3 to 5 surface feet of effluent waters per year to supply water needs for irrigated lands, phosphorus and trace elements added will not move downward to any great extent in most soils. Inert sands and gravels of low organic matter contents have low adsorptive capacities and allow rapid transmission of water. Water also generally moves more slowly in soils of higher clay content. Soils other than sands have a high capacity to retain arsenic, cadmium, chromium, copper, mercury, molybdenum, nickel, lead, selenium, and zinc. Where sludge of effluents are added to agricultural soils to supplement plant nutrients or as a source of irrigation water, essentially all of these trace elements applied should remain within the surface meter of soil. In groundwater recharge or disposal involving high application rates, movement of trace elements will depend on the amount and composition of the waters applied and the nature of the soil or sediment. (See also W77-00009) (Snyder-FIRL)  
W77-00029

#### ENVIRONMENTAL EFFECTS OF SLUDGE DISPOSAL IN SANITARY LANDFILLS

Environmental Protection Agency, Washington, D. C.  
B. R. Weddle.

In: Proceedings of the 1975 National Conference on Municipal Sludge Management and Disposal, August 18-20, 1975, Anaheim, California, p 188-192. 1 fig., 3 tab., 1 ref.

Descriptors: \*Pollutant identification, \*Environmental effects, \*Sludge disposal, \*Landfills, \*Land use, Sewage sludge, Public health, Soil contamination.  
Identifiers: Land application.

The land disposal of sewage sludge involves growing controversy. Advocates of spreading sludge on farmland face increased opposition on the grounds that sufficient information does not exist on the human health implications from long-term low-level injection of crops grown on sludge amended soil. This lack of information about survival and movement of pathogens in groundwater and soils is being used to 'kill' proposed projects for sludge disposal and utilization. The portion of the problem of ultimate sludge disposal dealing with environmental effects of subsurface disposal of municipal waste water sludges is discussed. The



## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5C—Effects Of Pollution

principal conclusions of an investigation of the environmental and economic effects of disposing liquid sludge and septic tank pumpings into a sanitary landfill are included. It was concluded that the solid wastes generated by a city should have adequate capacity to absorb all the water in its liquid digested sludge. A second study was undertaken to evaluate the environmental impact of mixed sludge/solid waste and 'sludge only' disposal sites. Nine sites were selected, including a range of operational practices, geographical, and climatological conditions. Wells were drilled to sample leachate and gas at the sites. The first data was not available in time to be included. (See also W77-00009) (Snyder-FIRL)  
W77-00030

**POTENTIAL HEALTH IMPACTS OF SLUDGE DISPOSAL ON THE LAND.**  
Environmental Protection Agency, Research Triangle Park, N.C.  
G. J. Love, E. Tompkins, and W. A. Galke.  
In: Proceedings of the 1975 National Conference on Municipal Sludge Management and Disposal, August 18-20, 1975, Anaheim, California, p 204-213. 1 tab, 136 ref.

Descriptors: \*Waste water treatment, \*Sewage treatment, \*Sewerage, \*Public health, \*Sludge disposal, Land use, Irrigation effects, Waste water(Pollution), Sludge, Agriculture, Pathogenic bacteria, Viruses, Chemicals.

The potential for adverse human health effects associated with waste water treatment and disposal systems is related to many pathogens and other pollutants with multiple pathways to man. A wide variety of pathogenic bacteria, viruses, and parasites occur in sewage. Effluent and sludges both contain significant numbers of pathogens after primary treatment, but ozonation, pasteurization, gamma radiation, and chlorination can be used to kill pathogens. Pathogens can travel over fairly large distances in aerosols from sewage or sludge spraying, but seldom travel very far in soil. Possible routes of infection include ground-water contamination, aerosols, direct contact with contaminated environments, transmission by wild animals coming into contact with sewage or sludge, and infection of crops. The infectivity of virus appears high, and some routes of infection can involve the production of large numbers of bacterial cells. Little is known about the possible health effects from chronic ingestion of small quantities of organic and inorganic compounds and heavy metals. Obviously a potential for adversely affecting human health is associated with applying waste waters or sludge to agricultural lands. The degree of risk relates to soil types on which the materials are applied, the treatment of the wastes, and care exercised by individuals involved in treatment or land application. The greatest hazard would probably result from disrupting good treatment or sanitary practices. The use of waste waters and sludges to fertilize and irrigate crops in many areas suggests, despite associated disease outbreaks, that the practice can function safely. The limited quantities of essential chemicals and water available to produce food makes it necessary to find a safe use for waste water and sludge. (See also W77-00009) (Snyder-FIRL)  
W77-00033

**FDA'S OVERVIEW OF THE POTENTIAL HEALTH HAZARDS ASSOCIATED WITH THE LAND APPLICATION OF MUNICIPAL WASTE-WATER SLUDGES.**  
Food and Drug Administration, Washington, D.C.  
For primary bibliographic entry see Field 5E.  
W77-00034

**BIOASSAY PROCEDURES FOR THE OCEAN DISPOSAL PERMIT PROGRAM.**  
Environmental Protection Agency, Gulf Breeze, Fla. Environmental Research Lab.  
For primary bibliographic entry see Field 5A.

W77-00041

**BEFORE REMOVING NUTRIENTS...RE-ANALYZE LAKE TAHOE.**  
Utah Water Research Lab., Logan.  
D. B. Porcella, and P. H. McGahey.  
Water and Wastes Engineering, Vol. 13, No. 2, p 17-19, 23, 44, February, 1976. 1 fig, 2 tab.

Descriptors: \*Reclaimed water, \*Algae, \*Nutrients, \*Reservoirs, \*Plant growth, Reclamation, Phosphorus, Nitrogen, Phytoplankton, Phytotoxicity, Organic compounds, Irrigation, \*Nutrient removal.  
Identifiers: Lake Tahoe, Indian Creek Reservoir.

The use of tertiary effluent as irrigation water for the Indian Creek Reservoir is discussed in relation to the effect of nutrient addition on algal blooms. Observations made at the reservoir after its filling revealed a water quality which is conducive to aquatic weed development but not to phytoplankton blooms. Influent nutrient levels indicated that substantial plant productivity should be observed, and the aquatic weed growth confirmed this to be the case. Factors which may have a role in controlling the presence and quantity of blue green algae in Indian Creek Reservoir include: the presence of excess inorganic nitrogen relative to low phosphorus concentrations, low levels of trace elements which may be limiting to blue greens and other algal groups, the low phosphorus levels in reservoir waters, low concentrations of biostimulatory organic compounds which are probably removed by activated carbon treatment, and the possible toxicity of high nitrogen levels to specific algae. (Kreager-FIRL)  
W77-00045

**CAUSES AND ALTERNATIVE SOLUTIONS TO THE WATER QUALITY PROBLEMS OF BIG STONE LAKE, WESTERN MINNESOTA-NORTHEASTERN SOUTH DAKOTA.**  
Midwest Research Inst., Kansas City, Mo.  
A. R. Hylton, R. Flippin, A. Alet, J. R. Ward, and J. Rasmussen.  
Journal of Environmental Sciences, p 27-32, May/June, 1976. 5 fig, 1 tab, 11 ref.

Descriptors: \*Water pollution effects, \*Eutrophication, \*Lakes, \*Algae, Minnesota, South Dakota, Phosphates, Nitrates, Turbidity, Silts, Nutrients, Fish, Reservoirs, Economics, Dredging, Pollution abatement.  
Identifiers: \*Big Stone Lake(Minn-SD).

Eutrophication problems associated with Big Stone Lake, a natural lake which lies in the valley of a former glacial river at the western Minnesota-northeastern South Dakota border, are discussed along with some alternatives for eliminating the problem. There are three general types of algae common to the lake: filamentous algae, free floating planktonic algae, and planktonic blue-green algae. The most obvious water quality changes which have occurred in the lake in recent years are an enrichment in phosphates and nitrates and increased siltation and turbidity. The adverse effects of man's influence on the lake's environment may be partially corrected by the following measures: reducing nutrient inflow from feedlots, selective dredging, periodic removal of rough fish, the use of upstream reservoirs, and acceptable land treatment measures. An analysis of the comparative economics of the above control measures is also presented. (Kreager-FIRL)  
W77-00047

**CLOSED LOOP HIERARCHICAL CONTROL FOR RIVER POLLUTION.**  
Saint John's Coll., Cambridge (England).  
For primary bibliographic entry see Field 5G.  
W77-00051

**IS NUTRIENT REMOVAL WORTHWHILE.**  
Iowa State Univ., Ames. Dept. of Animal Ecology.  
For primary bibliographic entry see Field 5D.  
W77-00065

**THE RELATION OF AEROGENIC TO ANAEROGENIC AEROMONADS OF THE 'HYDROPHILA-PUNCTATA-GROUP' IN RIVER WATER DEPENDING ON THE POLLUTION LEVEL. (IN GERMAN).**  
Frankfurt Univ. (West Germany). Hygiene-Institut.  
R. H. W. Schubert.  
Zentralbl Baktériol Parasitenkd Infektionskr Hyg Erste Abt Orig Reihe B Hyg Praev Med. 160(3), p 237-245, 1975.

Descriptors: \*Aerobic bacteria, \*Anaerobic bacteria, \*Microorganisms, \*Water pollution sources, Rivers, Wastes.  
Identifiers: \*Aeromonads, Aeromonas-hydrophila, Aeromonas-hydrophila-anaerogenes, Aeromonas-punctata, Aeromonas-punctata-caviae, Saprobic systems, \*Aerogenic species, \*Anaerogenic species.

Analysis of the relationship between the aerogenic and anaerogenic Aeromonas spp. of the hydrophila-punctata group in moving waters with varying waste loads showed that in the sewage water the anaerogenic subspecies A. hydrophila anaerogenes and A. punctata caviae predominate over the aerogenic species A. hydrophila and A. punctata with an average of 78%. Polysaprobic rivers and brooks show a similar relation. The aerogenic aeromonads (mainly A. hydrophila) dominate over the anaerogenic aeromonads in oligosaprobic brooks with a low range of variation of the individual value of 90% on the average. The alpha- and beta-mesosaprobic rivers show (with a great variation of the values indicated at each test place) a relation of aerogenic to anaerogenic aeromonads of 39:61 for the alpha-mesosaprobics and 43:57 for the beta-mesosaprobics on an average; they are close to each other in an average analysis. The great differences in the individual value of both groups indicate that the determination of the relation of the aerogenic to anaerogenic aeromonads could show a more sensitive system of waste contamination or waste load than the saprobic system. Since the anaerogenic subspecies A. anaerogenes and A. p. caviae are ecologically similar and A. hydrophila of the aerogenic species is the widely predominating microorganism, determination of the relation of aerogenic to anaerogenic aeromonads of the hydrophila-punctata group is sufficient.—Copyright 1976, Biological Abstracts, Inc.  
W77-00112

**ENVIRONMENTAL EFFECTS OF ALTERNATIVE ENERGY DEVELOPMENTS IN THE NORTHERN GREAT PLAINS.**  
United Nations, New York.  
For primary bibliographic entry see Field 6G.  
W77-00115

**VOLATILE FATTY ACIDS IN BOTTOM DEPOSITS OF THE RYBINSK RESERVOIR, (IN RUSSIAN).**  
Akademiya Nauk SSSR, Moscow. Institut Biologii Vnutrennykh Vod.  
S. V. Monakova.  
Gidrobiol Zh 11(3), p 55-59, 1975.

Descriptors: \*Acids, Reservoirs, Seasonal, Benthos, Water pollution effects.  
Identifiers: \*Bottom deposits, \*Fatty acids, USSR, Volatile fatty acids, \*Rybinsk Reservoir(USSR), Volga River(USSR), Formic acid, Acetic acid.

The bottom deposits of the Rybinsk reservoir on the Volga (USSR) contain formic, acetic, propionic, butyric, valeric and caproic acids. The

contents of formic and acetic acids are 1-2 orders higher than the others. There was a decrease in the content of acids in late summer-early fall and a marked increase before freezing. No relationship was established between the type of bottom deposits and quantity of volatile fatty acids.—Copyright 1976, Biological Abstracts, Inc. W77-00126

**CHANGE OF BENTHIC COMPLEXES UNDER THE EFFECT OF OVERGROWTH IN EUTROPHIC LAKE BALTIN (IN RUSSIAN),** M. P. Koval'Kova. *Ekologiya* 6(3), p 80-82, 1975.

Descriptors: \*Eutrophication, \*Benthos, Lakes, \*Diptera, \*Fish stocking.

Identifiers: Chironomus-Biappendiculatus, Chironomus-Semireductus, \*Endochironomus-Albipennis, Macrophytes, Tanytarsus-Gregarius, White amur, \*Biocenoses, \*Lake Baltin(USSR).

Long-term observations were made of the effect on the benthic fauna of the overgrowth of Lake Baltin (area 753 ha, average depth 3.4 m, maximum depth 6.5 m) located on the eastern slope of the central Urals, 23 km from Sverdlovsk (USSR). During the past 30 yr the overgrowth of the lake has increased from 15-85%, as a result of which the established biocenoses have undergone considerable reorganization. For example, in 1948 the complex Chironomus f. l. semireductus + Tanytarsus gr. gregarius dominated in the benthos, whereas from 1962 the dominating role was played by the complex Endochironomus albipennis + Chironomus biappendiculatus. The pelophilic biocenose of benthic organisms was replaced by a phytoplanktonic one. The foraging conditions of the fish deteriorated and their growth and condition declined. Stocking of the white amur and renewal of net fishing have reduced the overgrowth of the lake by macrophytes, which in turn has improved the benthic biocenoses.—Copyright 1976, Biological Abstracts, Inc. W77-00140

**PRESENT STATE OF ZOOPLANKTON AND ZOOBENTHOS OF LAKE ADZHIKABUL (IN RUSSIAN),** For primary bibliographic entry see Field 2H. W77-00142

**NUMBER, GENERATION TIME AND PRODUCTION OF BACTERIA IN WATER OF THE SARATOV RESERVOIR (IN RUSSIAN),** Akademiya Nauk SSSR, Moscow. Institut Biologii Vnutrennykh Vod. A. N. Dzyuban. *Gidrobiol Zh* 11(3), p 14-19, illus. 1975.

Descriptors: \*Distribution patterns, \*Bacteria, \*Microorganisms, Seasonal, Reservoirs, Detritus, \*Productivity, Path of pollutants. Identifiers: Russian-Sfsr, USSR, Saratov Reservoir(USSR).

The distribution pattern of microorganisms in the reservoir (Russian SFSR, USSR) is determined to a large extent by its cascade arrangement. The total number of bacteria in it, as compared with that in the river before the improvement, decreased by 1-2 million/ml of water. The number of saprophytic microorganisms became several times as low due to a drop in the flow velocity and sedimentation of suspensions, with bacteria attached to them, and by a decrease in microflora and detritus income from the flood bed. Seasonal changes in the microflora amount in the reservoir are insignificant. Bacterial generation time varied within 7-31 h. The significant production was 0.93-45 mg/l on the average.—Copyright 1976, Biological Abstracts, Inc. W77-00143

**A FOUR-YEAR ANALYSIS OF VEGETATION FOLLOWING AN OIL SPILL IN A FRESH-WATER MARSH,** Smith Coll., Northampton, Mass. Dept. of Biological Sciences.

C. J. Burk. Available from the National Technical Information Service, Springfield, VA 22161 as PB-258 766, Price codes: A03 in paper copy, A01 in microfiche. University of Massachusetts Water Resources Research Center, Amherst, WRRR Pub. No. 71, Completion report FY-76-15, June 1976. 38 p, 6 fig, 13 tab, 17 ref. OWRT A-042-MASS(2). 14-31-0001-5021.

Descriptors: \*Freshwater marshes, Salt marshes, \*Marsh plants, Water pollution effects, \*Oil spills, Plant groupings, \*Vegetation, Oil pollution. Identifiers: Annual plant species, Perennial plant species.

Changes in the composition of vegetation occurring in a freshwater marsh were studied for four years following an accidental oil spillage. Total plant cover and diversity measured by species richness, mean species per quadrat, and the Shannon-Wiener function were progressively reduced in both high and mid-marsh zones for two years after the spillage. Eighteen of the species found before the spill were not found the season following. Perennial species tended to be less affected by the oil immediately following the spill than annual species. The species most markedly reduced included: *Cephalanthus occidentalis*, *Eleocharis acicularis*, *Leersia oryzoides*, *Ludwigia palustris*, *Marsilea quadrifolia*, *Oenoclea sensibilis*, *Pilea fontana*, and *Pontederia cordata*. Species essentially unaffected or increasing the season after the oil spill included: *Ceratophyllum demersum*, *Dulichium arundinaceum*, *Eleocharis palustris*, *Elodea nuttallii*, *Lysimachia terrestris*, *Nuphar variegatum*, *Polygonum coccineum*, *Potamogeton epiphydus*, and *Sagittaria latifolia*. The results are discussed in relation to work on the effects of oil spillage on saltmarsh vegetation. W77-00147

**FORT RIVER ECOSYSTEM: PRODUCTIVITY OF THE PERIPHYTON COMPONENT,** Massachusetts Univ., Amherst. Water Resources Research Center.

S. G. Fisher, and W. T. Summer. Available from the National Technical Information Service, Springfield, VA 22161 as PB-258 772, Price codes: A04 in paper copy, A01 in microfiche. WRRR Pub. No. 72, Completion Report FY-76-16, June 1976. 58 p, 7 fig, 2 tab, 62 ref. OWRT A-068-MASS(1). 14-31-0001-4021.

Descriptors: \*Primary productivity, \*Periphyton, Streams, Ecology, Ecosystems, \*Massachusetts, New England, Light, Water temperature, \*Chlorophyll, Monitoring, Respiration, Standing crops, Nutrients, Metabolism. Identifiers: \*Fort River(Mass).

The primary production and general ecology of the periphyton community of a New England lowland stream were studied over a 17-month period. Temperature, discharge, stream bed light, periphyton chlorophyll, and community structure data were monitored regularly. Mean stream bed chlorophyll concentrations ranged from 10 to 136 mg/m<sup>2</sup> (annual mean = 44 mg/m<sup>2</sup>). Seasonally distinct chlorophyll peaks coincided with stream bed light maxima occurring in early May, just prior to leaf out, and again in autumn after leaf fall. However, during midwinter, despite low light levels and high stream discharge, mean chlorophyll concentrations remained higher than summer values. At any given time of the year, stream bed rock-size better accounted for variations of chlorophyll concentrations between different stream sites than either light or current velocity. Productivity chambers were used to measure productivity and respiration rates of stream periphyton communities in situ. Periphyton colonized on natural substrates were

incubated within these chambers at various temperatures, light intensities and periphyton densities throughout an annual period. Periphyton community respiration was a function of temperature and benthic chlorophyll densities. The summer decline in periphyton standing crop, characteristic of many small streams is discussed. In Fort River, light, discharge, and grazing factors were not sufficient to explain this phenomenon. Although seasonal patterns of stream nutrient concentrations are not associated with seasonal variations in periphyton standing crop, at higher temperatures when increased rates of metabolism and nutrient uptake occur, nutrient limitation becomes more important. This effect is especially important for dense stands of periphyton where much of the population is sheltered from the current, and accounts for both the temperature dependence of the periphyton density to PG/chlor relationship and the low summer periphyton standing crop. W77-00149

**AGRICULTURAL RUNOFF AS A SOURCE OF HALOMETHANES IN DRINKING WATER,** Iowa Univ., Iowa City. State Hygienic Lab. For primary bibliographic entry see Field 5B. W77-00163

**ASSESSMENT OF PRACTICALITY OF REMOTE SENSING TECHNIQUES FOR A STUDY OF THE EFFECTS OF STRIP MINING IN ALABAMA,** Alabama Univ., University. Dept. of Geology and Geography.

T. H. Hughes, A. C. Dillion, III, J. R. White, Jr., S. E. Drummond, Jr., and W. G. Hooks. Available from the National Technical Information Service, Springfield, VA 22161 as N76-15534, Price codes: A09 in paper copy, A01 in microfiche. Final Report, July 1, 1973-June 30, 1975. 190 p, 41 fig, 25 tab, 56 ref, 4 append. NASA 1-3-80-0084(1F), NASA NAS8-29936.

Descriptors: \*Remote sensing, \*Strip mines, \*Erosion, \*Sedimentation, \*Mine drainage, Alabama, Acid mine water, Vegetation, Equations, Rill erosion, Gully erosion, Sheet erosion, Mining, Aerial photography, On-site investigations, Geochemistry, Chemical analysis, \*Pollutant identification. Identifiers: Mining reclamation, Strip mining effects.

The areal extent of strip mining was measured from aerial photographs for two mining areas. Reclamation by grading and revegetation was also observed on these photographs. Twenty slopes were selected within the Searles Area for measurement of the amount of material removed by rill and gully erosion. Three stages in the evolution of rill and gully channel profiles were recognized: Stage 1, the rill stage lasts three to six years after mining. Stage 2, the intermediate stage, lasts six to eight years. Stage 3, the gully stage begins twelve to fifteen years after mining. The volume of sediment in Bluff Creek was obtained by three methods: (1) Direct measurement, in the field, of the width and depth of sediment in the stream valley, construction of cross-sections and projections of average cross-sectional areas through the distance separating adjacent cross-sections; (2) Measurement and projection of the areas contained in stream terrace deposits; (3) From the measured cross-sections, an empirical equation was derived that relates the cross-sectional area to the width of the stream valley. A model for the production of acid mine water was developed. Samples of mine drainage from 22 stations were collected and analyzed. (Sims-ISWS) W77-00170

**SURFACE NUTRIENTS, CHLOROPHYLL-A AND PHAEOPIGMENT IN SOME SCOTTISH SEA LOCHS,** Dunstaffnage Marine Research Lab., Oban (Scotland).

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5C—Effects Of Pollution

L. Solorzano, and B. Grantham.

Journal of Experimental Marine Biology and Ecology, Vol. 20, No. 1, p. 63-76, 1975. 8 fig., 20 ref.

Descriptors: \*Nutrients, \*Chlorophyll, \*Pigments, \*Saline water-freshwater interfaces, Phytoplankton, Spring, Nitrates, Phosphates, Silicates, Freshwater, Productivity, Limiting factors, Inflow, Turbulence, Estuaries, Water circulation, Salinity, Europe, Runoff, Euphotic zone, Eutrophication.

Identifiers: \*Phaeopigments, Loch Creran(Scotland), Loch Etive(Scotland), Loch Linnhe(Scotland).

The influence of freshwater runoff on concentration and distribution of nutrients, chlorophyll, and phaeopigments during spring phytoplankton blooms in Lochs Creran, Etive, and Linnhe, Scotland, was studied. Nitrate, phosphate, and silicate concentrations were related to fluctuations in freshwater input and uptake by phytoplankton populations. Nitrate to phosphate and silicate ratios in Lochs Creran and Linnhe were similar, but values for Loch Etive were markedly different. Nitrate, not phosphate, was a critical factor in productivity of Lochs Creran and Linnhe. Limitation of these nutrients in Loch Etive was directly affected by the amount of freshwater entering the loch. Patchiness in chlorophyll and phaeopigments in Lochs Creran and Etive reflected factors, such as freshwater/seawater inflow, turbulence produced by loch topography, etc., which affect loch surface circulation. Delay in development of phytoplankton blooms in Loch Linnhe may be due to poor surface layer stability due to low runoff. Freshwater input is the most important factor determining initiation and support of phytoplankton populations; it adds nutrients, trace metals, and growth promoting factors; increases water column stability; and keeps cells in the euphotic zone. When freshwater runoff is relatively high, it increases phytoplankton dispersion in the zone of better illumination outside lochs, thus expanding production. (Buchanan-Davidson-Wisconsin) W77-00182

#### COMPOSITIONAL CHANGES OF A FUEL OIL FROM AN OIL SPILL DUE TO NATURAL EXPOSURE.

McGill Univ., Montreal (Quebec). Dept. of Civil Engineering and Applied Mechanics. For primary bibliographic entry see Field 5B. W77-00183

#### THE INFLUENCE OF HYDROLOGICAL CONDITIONS ON DISSOLVED AND SUSPENDED CONSTITUENTS IN THE MISSOURI RIVER.

Wisconsin Univ., Madison. Lab. of Hygiene. J. J. Delfino, and D. J. Byrnes. Water, Air, and Soil Pollution, Vol. 5, No. 2, p. 157-168, 1975. 1 fig., 2 tab., 28 ref.

Descriptors: \*River flow, \*Dissolved solids, \*Suspended solids, \*Missouri River, \*Runoff, \*Nebraska, Water quality, Chemical properties, Silica, Conductivity, Sodium, Calcium, Ions, Alkalinity, Chlorides, Sulfates, Turbidity, Nitrogen compounds, Phosphorus, Oxygen demand, Agricultural watersheds, Carbon, Potassium, Iron, Manganese, Zinc, Copper, Cations.

The variability in flow characteristics of a stretch of the Missouri River near Brownville, Nebraska, were studied over a three year period from 1970-1972. River discharges ranged from 10,000 cfs. The river's chemical composition was strongly influenced by discharge conditions through dilution of normal concentrations by runoff from rain and snowmelt or enhancement through suspended solids carried from land and scoured from the river bottom. Generally increased river discharge caused by runoff decreased the concentration of major dissolved ionic constituents in the river—

total dissolved solids, ammonia, soluble orthophosphate, sodium calcium, bicarbonate alkalinity, chloride, and sulfate. Turbidity, total suspended solids, total organic nitrogen, total phosphorus, chemical and biochemical oxygen demand, total organic carbon, potassium, iron, manganese, zinc, and copper concentrations became elevated with higher discharges; these values could be strongly correlated with total suspended solids in 1972. Since the major land use is agricultural, the investigation results should be considered when attempts are made to control non-point pollution sources. Data must be used cautiously when applying the results of a single sampling analysis in geochemical transport calculations due to the extreme variability in concentrations. (Buchanan-Davidson-Wisconsin) W77-00184

#### ISOLATION AND IDENTIFICATION OF BLUE-GREEN ALGAE PRODUCING MUDDY ODOR METABOLITES, GEOSMIN, AND 2-METHYLSOBORNEOL, IN SALINE LAKES IN MANITOBA.

Fisheries and Marine Service, Winnipeg (Manitoba). Freshwater Inst. For primary bibliographic entry see Field 5A. W77-00185

#### ALGAL PRODUCTIVITY IN 49 LAKE WATERS AS DETERMINED BY ALGAL ASSAYS.

Pacific Northwest Environmental Research Lab., Corvallis, Ore. W. E. Miller, T. E. Maloney, and J. C. Greene. Water Research, Vol. 8, p. 667-679, 1974. 11 fig., 7 tab., 12 ref.

Descriptors: \*Eutrophication, Analytical techniques, \*Lakes, \*Bioassay, \*Trophic level, Limiting factors, Calcium, Magnesium, Alkalinity, Carbon, Phosphorus, Nitrogen, Iron, Essential nutrients, Hardness(Water), \*Pollutant identification, Water pollution effects, \*Productivity. Identifiers: Selenastrum capricornutum, \*Algal assays, \*Algal productivity.

Algal assays were done on samples from 49 American Lakes to determine the limiting factor in algal productivity. There was high correlation between the trophic state of 23 lakes and the algal assay productivity response. No correlation was noted between calcium, magnesium, alkalinity, and carbon increases and the maximum yield of Selenastrum capricornutum in the samples. Phosphorus was limiting in 35 lakes, nitrogen in 8 lakes, and other nutrients in 6 lakes. Generally phosphorus limitation decreased as the lake's trophic state increased: 83% of low, 75% of moderate, 64% of moderately high, and 50% of high productivity lake waters were phosphorus-limited for algal growth. Lake waters with high orthophosphate concentrations are more likely to become algal growth-limited by nitrogen or another nutrient. In the presence of other essential nutrients, addition of 1.00 mg nitrogen and 0.05 mg phosphorus/liter should support 20-30 mg algal dry weight/liter. Only 5 of 11 autoclaved-filtered low productivity waters supported this much algal growth with nitrogen and phosphorus supplements, indicating that other nutrients were limiting or a toxicity factor was present. Manganese in autoclaved-filtered Lake Herman water inhibited algal growth. It is not known if manganese was directly toxic to the test algae or if it restricted the availability of essential nutrients. (Buchanan-Davidson-Wisconsin) W77-00187

#### EFFECTS OF OIL ON THE REPRODUCTION OF THE AMPHIPOD GAMMARUS OCEANICUS.

Swedish Water and Air Pollution Research Lab., Nyköping. Baltic Sea Lab. O. Linden. Ambio, Vol. 5, No. 1, p. 36-37, 1976. 1 tab., 1 fig., 7 ref.

Descriptors: \*Oil pollution, \*Water pollution effects, \*Reproduction, \*Amphipoda, Marine animals, Toxicity, Incubation, Larvae, Broods, Animal behavior, Fecundity. Identifiers: \*Gammarus oceanicus, Sub-lethal effects, Crude oil.

Long-term effects of sub-lethal amounts of crude oil on the reproduction of Gammarus oceanicus are described. When couples in the precopula stage were exposed to low oil levels in water, length of incubation was unaffected, but fewer larvae were produced by females exposed to oil. The percentage reduction in brood number was about 50% with smaller females and 20% with long females; in absolute numbers the reduction was similar for all sizes of females. Couples in the precopula stage were separated, then brought together in water containing 1, 10, 20, or 40 microliters of oil per liter of water. In unpolluted sea water and the lowest oil concentration, the male grasped the female shortly after introduction; by 24 hours all the couples had reentered into the precopulation stage. With higher oil concentrations, no couples were observed in the precopulation stage, except at the end of the experiment in samples containing 10 microliters oil/liter. The frequency with which the male and the female enter the precopulation stage, which is necessary for successful fertilization, decreased in the presence of low oil concentrations. Reduced fecundity due to sub-lethal concentrations of oil pollutants has serious ecological consequences. (Buchanan-Davidson-Wisconsin) W77-00188

#### EVALUATION OF THE TOXICITY OF SUBSTANCES BEING RELEASED INTO WATER BODIES FOR THE EARLY DEVELOPMENT OF FISH, (IN RUSSIAN).

Moscow State Univ. (USSR). Lab. of Water Toxicology. O. P. Danil'Chenko, and N. S. Stroganov. Vopr Ikhtiol 15(2), p. 346-355, 1975.

Descriptors: \*Toxicity, Water pollution effects, Embryonic growth stage, Chlorides, Fish, Perch. Identifiers: Acerina-Cernua, Cobitis-Taenia, Esox-Lucius, Gobio-gobio, Misgurnus-fossilis, Perca-Fluviatilis, Phoxinus-phoxinus, Rutilus-rutilus, \*Salicylanilide, \*Antiseptics, \*Triethylin chloride, Sodium pentachlorophenate, Roach.

Results are presented of an investigation of the effect of 3 antiseptics, triethylin chloride, salicylanilide and sodium pentachlorophenate, on the embryonic and early postembryonic development of freshwater fishes: pike (Esox lucius), perch (Perca fluviatilis), ruff (Acerina cernua), roach (Rutilus rutilus), elritze (Phoxinus phoxinus), gudgeon (Gobio gobio), loach (Misgurnus fossilis) and spiny loach (Cobitis taenia). An evaluation of the degree of toxicity of these substances in water bodies with respect to their effect on the early development of these fishes is given.—Copyright 1976, Biological Abstracts, Inc. W77-00189

#### THE GROWTH-PROMOTING ACTIVITY OF SOME ALGAL METABOLITES ON SCENESMUS ACUTUS.

Bulgarian Academy of Sciences, Sofia. Experimental Algology Section. G. Zolotov, G. Ilkov, and T. Toncheva. Proceedings of the Bulgarian Academy of Sciences, Vol. 28, No. 9, p. 1253-1256, 1975. 2 fig., 1 tab., 6 ref.

Descriptors: \*Plant growth substances, \*Algae, \*Metabolism, \*Scenedesmus, Alcohols, Bacteria, Laboratory tests. Identifiers: Scenedesmus acutus, \*Algal metabolites.

The sesquiterpene alcohol farnesol, aromatic beta-phenyl-ethyl alcohol, and ketole 4-hydroxy-4-



methyl-pentanone (diacetone alcohol) were identified in extracts from the green alga *Senedesmus acutus*, strain Tomaselli 8. Biological effects of these metabolites on *Senedesmus* growth for 90 days were determined. Increase in dry matter was the most marked biological effect. Farnesol caused the largest increase followed by diacetone alcohol and phenyl-ethyl alcohol. Cell counts also increased. Cell lengths increased with phenyl-ethyl alcohol and diacetone alcohol. All treated cells were rounded off. Therefore increased dry weights were due to increased cell dimensions, rather than cell numbers. In all treated cultures, cell dimensions and numbers were about the same on the fifteenth and nineteenth days, but dry matter decreased. All substances inhibited bacterial flora. Color changes suggested changes in the algal physiological state. More colonies developed with inoculations of treated cultures, indicating that the treated cells were in better condition; more colonies were obtained with phenyl-ethyl alcohol and fewer with farnesol. Their effects on growth were the same for the entire cultivation period. It is assumed that these materials accelerate ontogenetic development or increase autospore numbers. (Buchanan-Davidson-Wisconsin)  
W77-00190

**THE EXTRA 02 EVOLVED DURING NITRATE UTILIZATION BY CHLORELLA.**  
Centre d'Etudes Nucleaires de Cadarache, Saint Paul-lez-Durance (France). Department de Biologie.  
R. Gerster, G. H. Lorimer, and B. Vennesland.  
Plant Science Letters, Vol. 5, No. 4, p. 255-260, 1975. 1 fig., 1 tab., 8 ref.

Descriptors: \*Oxygen, \*Nitrification, \*Chlorella, \*Chlorophyta, Oxygen isotopes, Ammonia, Carbon dioxide, \*Algae, Mass spectrometry, \*Pollutant identification.  
Identifiers: \*Oxygen evolution.

Nitrate reduction by green algae and higher plants occurs in two steps, catalyzed by nitrate reductase and nitrite reductase. When nitrite reductase catalyzes reduction of nitrite to ammonia, six electrons are required. Four of the six electrons involved might come from the oxygen atoms of nitrite; the oxygen atoms from nitrite might contribute to oxygen evolved by chloroplasts. Because of nitrite oxygen instability, the green alga, *Chlorella vulgaris*, was fed nitrate-018. Nitrate addition to illuminated cells caused increased oxygen evolution in the presence and absence of added carbon dioxide. Nitrate oxygen did not contribute any significant label to oxygen evolved when nitrate was reduced. The rate of oxygen evolution measured in the presence of carbon dioxide and nitrate was larger than the sum of the rate measured with nitrate alone plus the rate measured with carbon dioxide alone. Either carbon dioxide utilization was stimulated by nitrate or nitrate utilization was stimulated by carbon dioxide, even in cells already rich in carbohydrate. Net carbon dioxide utilization decreased and/or carbon dioxide production increased during nitrate utilization. The net amount of extra oxygen evolved during nitrate reduction in the presence of carbon dioxide was 12.6 micromoles of oxygen. (Buchanan-Davidson-Wisconsin)  
W77-00191

**SUBSTITUTE CHEMICAL PROGRAM: INITIAL SCIENTIFIC AND MINIECONOMIC REVIEW OF MALATHION.**  
Midwest Research Inst., Kansas City, Mo.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-241 818, Price codes: A12 in paper copy, A01 in microfiche. Report EPA-540/1-75-005, March 1975. 260 p. 5 fig., 41 tab., 363 ref.

Descriptors: \*Environmental effects, \*Pesticides, \*Pesticide kinetics, \*Evaluation, Pesticide toxic-

ity, Crop response, DDT, Safety, Economic efficiency, Hydrolysis, Hazards, Oxidation, Formulation, Degradation(Decomposition), Pesticide residues, Regulation, Pathology, Lethal limit. Identifiers: \*Malathion, Pharmacology, Toxicology, Tolerance levels.

An initial scientific and microeconomic review, conducted to determine if there is sufficient data to make a judgment with respect to the safety and efficacy of Malathion as a registered substitute for DDT, is detailed. Its production and chemical formulation, use, pharmacology, toxicology, food tolerances, acceptable intakes, its fate and significance in the environment, use hazards, and an assessment of the efficacy and cost effectiveness are presented. Its environmental effects are evaluated in connection with its effect on aquatic life, wildlife, beneficial insects, residues in soil, water, and air, and nontarget plants; also discussed is its bioaccumulation, biomagnification, degradation, and environmental transport mechanisms. The federal and state regulations concerning its use; and its use patterns in agriculture (by major crops and regions), industry, governmental agencies, home and garden uses are presented. The basic producer of Malathion is the American Cyanamid Company and its estimated production volume in 1972 was 24 million pounds of active ingredients. Import volume was 153,769 pounds in 1972; the 1972 export volume is estimated to have been 8 million pounds of active ingredient. Figures are incomplete, thus care should be taken in interpreting results. This report represents a summary of scientific data obtained from various sources. (Auen-Wisconsin).  
W77-00192

**THE BENTHIC ECOLOGY OF LOCH LINNHE AND LOCH EIL, A SEA-LOCH SYSTEM ON THE WEST COAST OF SCOTLAND. IV. CHANGES IN THE BENTHIC FAUNA ATTRIBUTABLE TO ORGANIC ENRICHMENT.**  
Dunstaffnage Marine Research Lab., Oban (Scotland).  
T. H. Pearson.  
Journal of Experimental Marine Biology and Ecology, Vol. 20, No. 1, p. 1-41, 1975. 12 fig., 8 tab., 25 ref.

Descriptors: \*Benthic fauna, \*Succession, \*Water pollution effects, \*Organic matter, Pulp wastes, Anaerobic conditions, Biochemical oxygen demand, Biological communities, Biomass, Suspended solids, Varieties, Dominant organisms, Europe, Estuaries, Eutrophication.  
Identifiers: \*Loch Linnhe(Scotland), \*Loch Eil(Scotland).

Effects of pulp and paper mill effluents on benthic fauna of Lochs Linnhe and Eil due to organic enrichment of sediments, were studied. The effluent affected the system because of short-term biochemical oxygen demands caused by dissolved organic material in the effluent and long-term biochemical oxygen demands due to suspended solids, primarily macerated wood fiber. As organic enrichment increased, certain species were progressively eliminated and surviving species increased in numbers. Later species not usually in the original fauna immigrated and appeared specifically associated with sediments having very high organic contents. In the last succession stage even the specialized 'high organic' fauna was eliminated. Excessive organic deposition caused anoxic conditions at the sediment-water interface which resulted in elimination of all but a few annelid species. Minor variations in sediment type or salinity may initially cause benthic population changes at low levels of organic detrital input but they are overshadowed when organic matter input is increased the described successional changes are discussed in the light of recent hypotheses concerning ecological change in relation to environmental stress. (See also W72-03003) (Buchanan-Davidson-Wisconsin)  
W77-00196

**THE USE OF ERTS-1 TO MORE FULLY UTILIZE AND APPLY MARINE STATION DATA TO THE STUDY AND PRODUCTIVITY ALONG THE EASTERN SHELF WATERS OF THE UNITED STATES.**  
Old Dominion Univ. Research Foundation, Norfolk, Va.  
For primary bibliographic entry see Field 5A.  
W77-00198

**TECHNIQUES FOR ANALYSIS OF PARAFFIN HYDROCARBONS AND FOR INTERPRETATION OF DATA TO ASSESS OIL SPILL EFFECTS IN AQUATIC ORGANISMS.**  
National Marine Fisheries Service, Seattle, Wash. Northwest Fisheries Center.  
For primary bibliographic entry see Field 5A.  
W77-00219

**DETERMINATION OF N-ALKANE AND METHYLNAPHTHALENE COMPOUNDS IN SHELLFISH.**  
Battelle-Pacific Northwest Labs., Richland, Wash.  
For primary bibliographic entry see Field 5A.  
W77-00220

**EXPERIMENTAL ECOSYSTEMS TO MEASURE FATE OF OIL SPILLS DISPERSED BY SURFACE ACTIVE PRODUCTS.**  
Institut Francais du Pétrole, Rueil-Malmaison (France).  
For primary bibliographic entry see Field 5B.  
W77-00251

**A REINVESTIGATION OF SOUTHERN CALIFORNIA ROCKY INTERTIDAL BEACHES THREE AND ONE-HALF YEARS AFTER THE 1969 SANTA BARBARA OIL SPILL: A PRELIMINARY REPORT.**  
University of Southern California, Los Angeles. Allan Hancock Foundation.  
R. Cimberg, S. Mann, and D. Straughan.  
In: Prevention and Control of Oil Spills, Proceedings of Joint Conference, Washington, DC, March 13-15, 1973. p. 697-702, 2 fig., 1 tab., 17 ref.

Descriptors: \*Oil spills, \*Oil pollution, \*Water pollution effects, \*Environmental effects, \*Aquatic animals, \*Aquatic plants, California, Beaches, Intertidal areas, Sediments, Mortality.  
Identifiers: \*Outer Continental Shelf, Biological effects, \*Santa Barbara(CA), Substrates, Tide pools, Balanus, Chthamalus, Enteromorpha, Chaetomorpha, Ulva, Ralfsia, Porphyra, Endocladia, Hildenbrandia, Rhodoglossum.

Ten rocky intertidal beaches in southern California, which were surveyed for a 12-month period following the 1969 Santa Barbara oil spill, were reinvestigated in June and July of 1972. Data from this 1972 survey as well as data collected during the same months on the same beaches in 1969 and 1970 were analyzed by forming beach groupings using cluster analysis. This analysis indicates that sand movement and substrate stability are the two most important factors affecting the presence of marine organisms on these beaches during this period. Overall, the effect of the 1969 Santa Barbara oil spill on the presence and abundance of rocky intertidal organisms was less important than other environmental factors. Most mortalities reported were localized in tide pools and high intertidal areas. (See also W76-09312) (Sinha-OEIS)  
W77-00267

**THE RESPONSE OF MACROINVERTEBRATES TO GASOLINE POLLUTION IN A MOUNTAIN STREAM.**  
Environmental Protection Agency, Kansas City, Mo. Surveillance and Analysis Div.  
S. L. Bugbee, and C. M. Walter.

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5C—Effects Of Pollution

In: Prevention and Control of Oil Spills, Proceedings of Joint Conference, Washington, DC, March 13-15, 1973. p 725-731, 1 fig, 3 tab, 4 ref.

Descriptors: \*Environmental effects, \*Water pollution effects, \*Gasoline, \*Streams, \*Toxicity, \*South Dakota, Aquatic animals, Aquatic plants, Mountains, Sediments.

Identifiers: Biological effects, Aviation gasoline.

On November 23, 1969, a gasoline transport truck overturned on the U.S. Highway 16 bridge crossing Grace Coolidge Creek east of Custer in South Dakota, discharging an estimated 5,000 gallons of aviation gasoline to the stream. Immediately following the spill, the gasoline was flushed downstream with large volumes of water to reduce the fire hazard in the park area. The sudden increase in flow thoroughly mixed the gasoline in the stream incorporating some fractions into the sediments. The majority of aquatic invertebrates and about 2,500 fish (30% trout species) were killed for at least two miles downstream from the spill. Gasoline residues in the sediments on the rocks prohibited the recolonization of mayflies, stoneflies and certain caddisflies for at least six months following contamination. The midge *Orthocladus* was the most resistant organism. The reappearance of mayfly and stonefly nymphs in the contaminated reach of the stream 12 months after the spill indicated a significant degree of recovery in the macroinvertebrate community. The persistence of gasoline in the stream bed six months after the spill as well as the restricted rate of recolonization of macroinvertebrates demonstrates complicated, long-term problems resulting from the interaction of petroleum products with the environment. (See also W76-09312) (Sinha-OEIS) W77-00268

**TERRESTRIAL OIL SPILLS IN ALASKA: ENVIRONMENTAL EFFECTS AND RECOVERY,** Army Engineer Waterways Experiment Station, Vicksburg, Miss.

P. G. Hunt, W. E. Rickard, F. J. Deneke, F. R. Koutz, and R. P. Murrman.

In: Prevention and Control of Oil Spills, Proceedings of Joint Conference, Washington, DC, March 13-15, 1973. p 733-740, 12 fig, 16 ref.

Descriptors: \*Oil spills, \*Oil pollution, \*Water pollution effects, \*Environmental effects, \*Ecosystems, \*Permafrost, \*Microbial degradation, \*Alaska, Vegetation, Pipelines.

Identifiers: \*Biological effects, Petroleum, Nitrobenzene, Nitrosomonas, Crude oils.

Damage and natural recovery of terrestrial ecosystems affected by refined petroleum spills along the Haines to Fairbanks military pipeline in Alaska were investigated. Mosses and trees were completely killed, and vegetation is now sparse in the drier portions of the spill areas. Some new vegetation is growing in drainage pathways. The dead organic mat has provided adequate insulation, and only a few instances of slope instability where slopes exceed 20%, occurred. Through laboratory studies on the rates of microbial respiration in Fairbanks silt containing 15% Prudhoe crude, it was determined that microbial activity is increased by inoculation with mixed-culture oil-degrading microorganisms, increased pH, and phosphorus additions. Microbial activity also responds positively to nitrogen addition after an initial negative response. (See also W76-09312) (Sinha-OEIS) W77-00269

**A STUDY OF THE EFFECTS OF THE SAN FRANCISCO OIL SPILL ON MARINE ORGANISMS,** College of Marin, Kentfield, Calif.

G. L. Chan.

In: Prevention and Control of Oil Spills, Proceedings of Joint Conference, Washington, DC, March 13-15, 1973. p 741-781, 26 fig, 13 ref, 15 append.

Descriptors: \*Oil spills, \*Oil pollution, \*Water pollution effects, \*Environmental effects, \*California, Aquatic animals, Reefs, Aquatic plants, Mussels, Intertidal areas, Beaches, Shores, Coasts, Bays.

Identifiers: \*Outer Continental Shelf, Biological effects, Collisions, Littorina spp. *Acmaea* spp. *Mytilus*, *Balanus*, *Urosalpinx*, *Endocladia*, *Gigartina*, *Phyllospadix*, *Tegula*, San Francisco Bay (Calif).

The San Francisco oil spill occurred on January 18, 1971, during the early morning hours when two Standard Oil vessels collided almost directly under the Golden Gate Bridge, releasing 840,000 gallons of Bunker C fuel. This asphalt-like oil was washed up on intertidal shores of the area. The oil was heavily deposited on the Duxbury Reef's mussel beds and high tidal berm rocks. It was determined that marine organisms died from being smothered by the oil, with certain species, such as acorn barnacles and limpets, suffering the highest mortality at Sausalito and on Duxbury Reef. Comparison of pre-oil and post-oil transect counts showed there was a significant decrease in marine life after the oil spill on the reef. Marine snails suffered less mortality than the sessile barnacles and other sedentary animals. The normally large population of striped shore crabs is missing from the rocky crevices. Finally, marine algal blooms were also observed in certain reef localities. The present conditions of Duxbury Reef (December, 1971) is one of apparent good health; the recruitment of some marine animals appear to be approaching normal levels. The oil has disappeared from much of the reef surfaces and is barely discernible in the most heavily deluged areas. (See also W76-09312) (Sinha-OEIS) W77-00270

**INTERAGENCY INVESTIGATIONS OF A PERSISTENT OIL SPILL ON THE WASHINGTON COAST,**

National Marine Fisheries Service, Seattle, Wash. R. C. Clark, Jr., J. S. Finley, B. G. Patten, D. F. Stefani, and E. E. DeNike.

In: Prevention and Control of Oil Spills, Proceedings of Joint Conference, Washington, DC, March 13-15, 1973. p 793-808, 12 fig, 5 tab, 18 ref.

Descriptors: \*Oil pollution, \*Oil spills, \*Water pollution effects, Aquatic animals, Aquatic plants, \*Environmental effects, \*Washington, Coasts, Beaches, Intertidal areas, Crabs, Algae.

Identifiers: \*Outer Continental Shelf, Biological effects, Urchins, Barnacles, Paraffin hydrocarbons, Petroleum hydrocarbons, Fuel oil, Mitella polymorus, Strongylocentrotus purpuratus, Hemigrapsus nudus, *Fucus* gardneri.

An interagency team of biologists, chemists, oceanographers and engineers investigated the long-term effects of oil spilled by the grounding of the troopship GENERAL M.C. MEIGS January 6, 1972, on an ocean coast intertidal community of plants and animals. Oil was released from the 440,000 liters of Navy Special Fuel Oil carried by the vessel. A series of sites, forming a vertical profile of the rocky shelf area from the upper intertidal zone to the lowest low tide level in Wreck Cove was studied. This report describes the preliminary findings of the first ten months (January-October, 1972) of the investigation. Abnormal and dead urchins indicated that this species was affected. Loss of fronds and bleached thalli not evident in control areas were observed in the plant community in the immediate vicinity of the hulk. Petroleum hydrocarbons were taken up in the intertidal community. The normal paraffin hydrocarbon patterns and content over the range n-C14H30 to n-C37H76 of healthy-appearing

goose barnacles, crabs, and an alga display the same basic characteristics as the fuel oil which had been lost. (See also W76-09312) (Sinha-OEIS) W77-00271

**CHROMOSOME MUTAGENESIS IN DEVELOPING MACKEREL EGGS SAMPLED FROM THE NEW YORK BIGHT,**

National Oceanic and Atmospheric Administration, Boulder, Colo. Marine Ecosystems Analysis Program Office.

A. C. Longwell.

NOAA Technical Memorandum ERL MESA-7, April 1976. 64 p, 4 tab, 16 plates, 106 ref.

Descriptors: \*Fish eggs, \*Water pollution effects, Heavy metals, Fishes, Cadmium, Pesticides, Metals, Radiation, \*Embryonic growth stage, Sampling.

Identifiers: \*Chromosome abnormalities, \*Mutagenesis, \*Genetic damage, \*Mutagens, \*New York Bight, \*Mackerel eggs, *Scomber scombrus*, Cyto-genetics, Chromosome mutagenesis, Atlantic mackerel.

Altogether 30,689 embryo cells were scored in 452 eggs from the 14 different stations in the New York Bight collected from surface waters during the May 7-18, 1974 cruise of the Westward. Less than 20% of the eggs had all their dividing cells free from chromosome and division abnormalities. One-third of the 30,689 division figures scored for all the embryos were abnormal. All but an insignificant number of eggs sampled were those of *Scomber scombrus*, the Atlantic mackerel. Abnormalities of the chromosomes extended through the entire range of radiomimetic effects on the chromosomes and their division apparatus, including extreme stickiness of chromosomes having obvious division difficulties and irregularities, failure of chromosomes to orient on spindles, with consequent loss of chromosomes, and chromosome breakage. Not all chromosome or division irregularities are microscopically detectable even with the most refined methods. Only a portion of observable abnormalities would be expected to be recorded with the cyto-genetic scoring system used in this study. The collection of the Westward data on largely the early embryo stage means that the earlier stage zygotes, so chromosomally abnormal that they could not gastrulate, are not represented. Differences between best and worst stations are so minimized. (NOAA) W77-00274

**EFFECTS ON COMMERCIAL FISHING OF PETROLEUM DEVELOPMENT OFF THE NORTHEASTERN UNITED STATES,**

Woods Hole Oceanographic Institution, Mass. Marine Policy and Ocean Management Program. D. W. Allen, R. B. Allen, R. E. Black, J. M. Friedman, and L. G. Mallon.

Report No. WHOI-76-66, April 1976. 80 p, 40 fig, 11 tab, 96 ref. SG-04-6-158-44016.

Descriptors: \*Northeast US, \*Commercial fishing, \*Oil pollution, \*Oil spills, \*Water pollution effects, \*Fisheries, \*Environmental effects, \*Continental Shelf, \*Resources development, Oil industry, International law, Damages, Compensation, Jurisdiction.

Identifiers: \*Outer Continental Shelf, Northeast US Coast, Baltimore Canyon, Georges Bank, New England States, Offshore technology, Environmental impact.

A study of the possible effects of future offshore petroleum development on the commercial fishing industry of the New England and Mid-Atlantic states is reported. The study was based on a variety of sources: two workshops involving fishermen, government officials and oil industry representatives; visits to the Gulf of Mexico and the North Sea; interviews with state coastal zone planning officials and with federal officials responsible for offshore development; interviews

with and questionnaires from fishermen; and finally, the analysis of existing fisheries data and the review of previous studies. The report considers the effects on fisheries in three general categories: offshore interactions, onshore interactions, and pollution effects. Estimates are made of the probable magnitude of these effects on commercial fishermen and recommendations are made to minimize undesired consequences. The report also contains general descriptions of the physical environment on the continental shelf of the area; the commercial fishing industry; the technology of the petroleum industry; and the legal and regulatory framework governing the industries on the continental shelf. (NOAA)

W77-00280

**CHANGE OF THE BIOCHEMICAL COMPOSITION OF MUSSELS UNDER CONDITIONS OF REGULATED FLOW OF THE DNIPEP, (IN RUSSIAN).**  
Akademiyi Nauk URSS, Kiev. Instytut Hidrobiologii.

T. I. Birger, and A. Ya. Malyarevskaya.  
Gidrobiol Zh 11(3), p 72-76, 1975.

Descriptors: \*Mussels, Biochemistry, Reservoirs, \*Bioindicators, Protein, Regulation, \*Reservoir operation.

Identifiers: Ash, Dreissena-Bugensis, Dreissena-Polymorpha, USSR, \*Dnieper River(USSR), Caloric content.

The effect of the regulated flow of the Dnieper River (USSR) in the variability of the biochemical composition of mussels, *Dreissena polymorpha* and *D. bugensis* was determined. During the 1st years after construction of the reservoirs, when formation of the hydrochemical and hydrobiological regimes is occurring and a diversity of habitats is being created, the variability of all indices of biochemical composition increases considerably. As the reservoirs age the variability of the indices decreases. In the mussels there is a decrease in protein and of the caloric value and an increase of the ash content in comparison with these indices in mussels of the same species from the river.—Copyright 1976, Biological Abstracts, Inc.

W77-00281

**INTERACTION BETWEEN AQUATIC PLANTS AND BED SEDIMENTS IN MERCURY UPTAKE FROM FLOWING WATER.**

National Research Council of Canada, Ottawa (Ontario). Div. of Biological Sciences.

D. C. Mortimer, and A. Kudo.

The Journal of Environmental Quality, Vol. 4, No. 4, p 491-495, October-December 1975. 6 fig, 7 tab, 8 ref.

Descriptors: \*Mercury, \*Aquatic environment, Aquatic life, \*Aquatic plants, Aquatic soils, \*Bottom sediments, \*Canada, \*Absorption.

Identifiers: \*Ottawa River(Ont), \*Elodea densa, Mercuric chloride, Methyl-mercuric chloride.

Bed sediment from a known zone in the Ottawa River study area and cuttings of *Elodea densa* were set out in aquaria in a 24-day controlled, flowing water experiment. *Elodea* was planted in sediment and in glass beads, and sediment was exposed with and without plants, all in the same aquaria for 7 days before the addition of mercury with 203 Hg. Three concentrations each of mercuric chloride and methyl mercuric chloride were continuously metered into the input water to yield aquarium levels of 0.2, 2, and 10 micro-g/liter. There was no significant difference in the uptake rate between the two forms of mercury. Uptake was proportional to water concentration over the entire 17-day exposure period in both plants and sediment. Methyl mercury was more toxic to plant growth in this time interval than inorganic mercury. (Skogerboe-Colo St)

W77-00301

**LITTORAL ZOOPLANKTON OF THE BAIKAL OPEN ZONE, (IN RUSSIAN).**

Limnologicheskii Institut, Irkutsk (USSR).

For primary bibliographic entry see Field 2H.

W77-00333

**A RAPID METHOD FOR MEASURING THE ACUTE TOXICITY OF PULP MILL EFFLUENTS AND OTHER TOXICANTS TO SALMONID FISH AT AMBIENT ROOM TEMPERATURE.**

B. C. Research Ltd., Vancouver.

D. J. McLeay.

Journal of the Fisheries Research Board of Canada, Vol. 33, No. 6, p 1303-1311, June, 1976. 6 tab, 24 ref.

Descriptors: \*Pulp wastes, \*Toxicity, \*Salmonids, \*Bioassay, Analytical techniques, Wastes, Industrial wastes, Water pollution sources, Water pollution effects, Lethal limit, Rainbow trout, Fish, Dissolved oxygen, Water pollution, Zinc, Phenols, Toxins, Pollutants, Chlorinated hydrocarbon pesticides.

Identifiers: Coho salmon (*Oncorhynchus kisutch*), Dehydroabietic acid, Lindane (Gamma-benzene hexachloride), Chlorine compounds, Resin acids.

A residual oxygen bioassay performed at ambient room temperature is examined as a rapid method for measuring the acute toxicity of pulp mill effluents and other toxicants to salmonid fish. Tests results are evaluated in comparison with 96-hr LC(50) bioassays. At test temperatures of 19-22 C and coho salmon (*Oncorhynchus kisutch*) loadings of 4-5 g/liter, residual oxygen levels were elevated in effluent concentrations equivalent to 0.5-0.9 of the samples' 96-hr LC(50) values; these tests were completed within 5-6.5 hr. Sensitivity increased only slightly with a loading of 1 g/liter and this test required 18 hr for completion. Decreasing the number of fish per jar from 4 to 1 while holding fish loadings constant by varying the size of the test containers did not alter the tests' sensitivity. Results indicate that, with a loading of 4-5 g fish/liter and 10 replicates of 1 fish/jar, a residual oxygen bioassay at ambient room temperature is more sensitive than a 96-hr LC(50) batch replacement bioassay (2 liters/g fish/day). Under these conditions fish requirements are identical; the residual oxygen test is completed within 6.5 hr and 32- to 40-fold reduction in volume of test solutions required is achieved. The procedure was evaluated with rainbow trout (*Salmo gairdneri*) using dehydroabietic acid, zinc, phenol, and lindane. Significant responses occurred with these toxicants at concentrations equivalent to 0.5-1.0 of the samples' 96-hr LC(50) values and higher. (Witt-IPC)

W77-00336

**KLEBSIELLA DENSITIES IN WATERS RECEIVING WOOD PULP EFFLUENTS.**

Environmental Protection Agency, Dauphine Island, Ala. Gulf Coast Water Supply Research Lab.

B. E. Huntley, A. C. Jones, and V. J. Cabelli.

Journal Water Pollution Control Federation, Vol. 48, No. 7, p 1766-1771, July, 1976. 1 fig, 3 tab, 17 ref.

Descriptors: Enteric bacteria, Aquatic bacteria, \*Coliforms, \*Pulp wastes, \*Salmonella, \*Alabama, \*Water pollution sources, Wastes, Industrial wastes, Water pollution, E. coli, Bacteria, Aerobic bacteria, Water temperature, Hydrogen ion concentration, Public health, Microorganisms, Aquatic microorganisms, Effluents, \*Path of pollutants, Bays.

Identifiers: \*Enterobacter, \*Klebsiella, \*Mobile Bay(Ala), Garrows Bend(Ala).

The distribution of coliform biotypes and *Salmonella* species in waters below a pulp mill on Garrows Bend off the northwest tip of Mobile Bay, Alabama, was determined. The bacterial iso-

lates were obtained from gauze traps and surface water grab samples. Water temperature and pH were monitored. Of the organisms isolated, 60% were identified as *Klebsiella* and 34% as *Escherichia coli*. The remaining 6% were primarily members of the genus *Enterobacter*. Only one *Salmonella* isolate was obtained, a group C *Salmonella*. The findings are discussed in terms of potential health effects and the interpretation of total and fecal coliform data from such waters. (Witt-IPC)

W77-00337

**ON THE EUTROPHICATION IN THE LAKE CHANGJA, (IN KOREAN).**

Seoul National Univ. (Republic of Korea). Dept. of Botany.

K. Lee, K. B. Uhm, and Y. M. Kwon.

Korean J Bot 18(3), p 135-138, 1975.

Descriptors: \*Eutrophication, Lakes, Asia, Bacteria, Water pollution effects, Water temperature, Stratification, Dissolved oxygen, Phosphorus, Nitrogen, Chlorophyll, Coliforms.

Identifiers: \*Lake Changja(Korea).

The process of eutrophication was studied in Lake Changja, Korea, from Nov. 1974-May 1975. Water temperature stratification occurred in April; the dissolved O<sub>2</sub> content varied slightly; it was almost 0 beginning in Jan. Total P increased very rapidly in Feb.; total N and carbohydrate-like substances increased slightly. The amount of chlorophyll-alpha varied from 127-717 mg/m<sup>2</sup> with maximum value in Jan.; chlorophyll-alpha and total P related to each other. The numbers of coliform bacteria at point A were 10 times greater than at point B. Lake Changja is very eutrophic; its ecological equilibrium cannot be recovered until the origin of pollution is eliminated.—Copyright 1976, Biological Abstracts, Inc.

W77-00344

**THE EFFECT OF SURFACE-ACTIVE SUBSTANCES ON PATHOGENIC ENTEROBACTERIA IN WATER, (IN RUSSIAN).**

Moskovskii Gosudarstvennyi Meditsinskii Institut (II) (USSR).

V. V. Shelakova.

Gig Sanit 3, p 25-28, 1975.

Descriptors: \*Pathogenic bacteria, Bacteria, \*Ions, \*Salmonella, Inhibition, Cations, Anions, Water pollution effects.

Identifiers: \*Salmonella-typhimurium, \*Surface-active substances, LD50.

The anion-active and nonionogenic surface-active substances (SAS) at concentrations of 10-20 mg/l can stimulate *Salmonella* multiplication. The cation-active SAS when present at high concentrations inhibit *Salmonella* multiplication. In case of simultaneous entry into the body of SAS and the infectious agent (*S. typhimurium*) the value of its LD50 diminished and its virulence increased. Contamination of water bodies with SAS may deteriorate their sanitary-epidemic situation.—Copyright 1976, Biological Abstracts, Inc.

W77-00346

**THE BEHAVIOR OF PSEUDOMONAS AERUGINOSA IN SURFACE WATER, COOLING WATER AND WASTE WATER, (IN GERMAN).**

Bonn Univ. (West Germany). Hygiene Institut.

For primary bibliographic entry see Field 5B.

W77-00347

**POSSIBILITIES OF DETERMINING COMMUNITY BOUNDARIES WITHIN THE LIMITS OF A LAKE ECOSYSTEM, (IN RUSSIAN).**

Nature Conservation, Game Preserves and Hunting, Moscow (USSR). Central Lab.

For primary bibliographic entry see Field 2H.

W77-00367



## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5C—Effects Of Pollution

**ENVIRONMENTAL IMPACT OF STREAM CHANNELIZATION.**  
Baker (Michael), Jr., Inc., Beaver, Pa.  
For primary bibliographic entry see Field 6G.  
W77-00375

**GEOGRAPHICAL AND SEASONAL VARIABILITY OF MARINE PLANKTON.**  
Akademiya Nauk SSSR, Leningrad.  
Zoologicheskii Institut.  
Available from the National Technical Information Service, Springfield, VA 22161 as TT-74-50030. Price codes: A14 in paper copy, A01 in microfiche. TT-74-50030, 1975. Translated from Izdatelstvo 'Nauka,' Leningradskoe Otdelente, Leningrad, 1972. B. E. Bykhovskii, editor. 309 p.

Descriptors: \*Ecological distribution, \*Marine microorganisms, \*Oceans, \*Zooplankton, Systematics, Speciation, Phylogeny, Evolution, Copepods, Latitudinal studies, Ecotypes.  
Identifiers: Morphogenesis, Calanidae, Oithonidae.

Because of vast protein resources in the world oceans investigations conducted by the Laboratory of Marine Research attached to the Zoological Institute of the USSR Academy of Sciences are presented. They relate to planktonic ecology, systematics, speciation, morphogenesis, phylogeny, and microevolution. Results of variation statistics and comparative functional-morphological studies of copepod populations collected by Soviet expeditions to different oceans are presented. A new classification for the family Calanidae based on phylogenetic relationships and closely related to oceanic zoogeographic zones was developed. The polymorphic species *Calanus plumchris* in the North Pacific has three independent forms with their own geographical range. Some species of the family Oithonidae display a complex geographical variability. Morphological details of the genus *Calanus* mouth apparatus are described; changes occurred depending on diatom or dinoflagellate predominance in crustacean food, which is a function of latitudinal zonation. Studies of seasonal shifts, distribution, and ecology of planktonic complexes in little explored parts of the ocean and Antarctica coastal waters are reported. The articles cover a cross-section of the main trends in plankton research being done at the Academy's Department for Plankton and Lower Crustacea to clarify the qualitative composition of oceanic plankton. (See W77-00394 thru W77-00401) (Buchanan-Davidson-Wisconsin) W77-00393

**PHYLOGENY OF THE FAMILY CALANIDAE(COPEPODA) ON THE BASIS OF A COMPARATIVE MORPHOLOGICAL ANALYSIS OF ITS CHARACTERS.**  
Akademiya Nauk SSSR, Leningrad.  
Zoologicheskii Institut.  
K. A. Brodskii.

In: Geographic and Seasonal Variability of Marine Plankton, TT-74-50030, 1975. Translated from Izdatelstvo 'Nauka,' Leningradskoe Otdelente, Leningrad, 1972. B. E. Bykhovskii, editor, p. 1-127. 123 fig., 21 tab., 34 ref. 27 ref.

Descriptors: \*Marine microorganisms, \*Phylogeny, \*Copepods, \*Systematics, Speciation, Ecological distribution, Environmental effects, Latitudinal studies, Spatial distribution, Oceans, Fish food organisms, Zooplankton.  
Identifiers: \*Calanus, Calanoides, Neocalanus, Nannocalanus, Canthocalanus.

The systematics of the family Calanidae (Copepoda) of all known species in the world oceans are examined and classified according to the following characters: Female genitalia, fifth pair of male or female limbs, body length, antennule length, cephalothorax form, last thoracic segment form, structure of first pair of female limbs,

and special formations (morphological peculiarities of the swimming feet of different species). Parameters of the species *Undinula* related to length of the body and the antennules, number of setae, etc., were not considered. Species of genus *Calanus* were considered valid and the subgenera analyzed. Certain morphological features such as length and form of the body and armature of first and fifth pairs of limbs depend on ecological conditions related to latitudinal zones. A phylogenetic scheme is established for the family according to chronological and spatial principles. Relationships were found between variations in certain of these parameters in individuals of species of the genus *Calanus* and related genera and the ecogeographic conditions of latitudinal oceanic zones. Degrees of primitiveness or specialization were assessed on the basis of these relationships. A key to species is given. A new species, *Calanus* (*Carinocalanus*) *macrocarinatus*, is described. (See also W77-00393) (Buchanan-Davidson-Wisconsin) W77-00394

**ZOOPLANKTON OF DIKSON BAY (KARA SEA).**  
Akademiya Nauk SSSR, Leningrad.  
Zoologicheskii Institut.  
L. L. Chistenko.

In: Geographic and Seasonal Variability of Marine Plankton, TT-74-50030, 1975. Translated from Izdatelstvo 'Nauka,' Leningradskoe Otdelente, Leningrad, 1972. B. E. Bykhovskii, editor, p. 263-274. 3 fig., 3 tab., 10 ref.

Descriptors: \*Marine microorganisms, \*Zooplankton, \*Temporal distribution, \*Arctic Ocean, Varieties, Annelids, Dominant organisms, Biological communities, Biomass, Copepods, Mollusks, Crustaceans, \*Bays.  
Identifiers: \*Dikson Bay(USSR), \*Kara Sea.

Seasonal changes in zooplankton were studied in the high Arctic area of Dikson Bay (Kara Sea) in 1955-1957. In the 48 zooplankton forms found, 28 species were determined—twenty species were marine, five species brackish-water, and three species freshwater forms. The marine forms were largely neritic coldwater Arctic species, but oceanic species were fairly abundant in the plankton. The brackish-water forms were autochthonous to the brackish Arctic waters; three were endemic to the high Arctic. Freshwater organisms were qualitatively and quantitatively small. The average biomass was 121 mg/cu m. The percentage composition of the average biomass was Copepoda 55.8% (Calanoids 53.5%), Chaetognaths 18.6%, Mollusca 13.3%, higher Crustacea 4.2%, Polychaeta 3.3%, Hydromedusae 1.9%, and other organisms 2.9%. Of the total zooplankton biomass, Sagitta accounted for 18.6%, Limnocalanus grimaldii, 17.4%, Calanus galacialis 13.7%, Pseudocalanus elongatus 7%, and Drepanopus bungei 7%. A springtime state of plankton was observed before onset of the thaw when the water was still frozen. There was no partial resumption of springtime processes during fall homothermy. Extremely variable hydrologic conditions in this area complicated the pattern of seasonal biological processes. (See also W77-00393) (Buchanan-Davidson-Wisconsin) W77-00395

**STRUCTURE OF THE MANDIBLES IN THE GENUS CALANUS S.L. IN RELATION TO LATITUDINAL ZONALITY.**

Akademiya Nauk SSSR, Leningrad.  
Zoologicheskii Institut.

In: Geographic and Seasonal Variability of Marine Plankton, TT-74-50030, 1975. Translated from Izdatelstvo 'Nauka,' Leningradskoe Otdelente, Leningrad, 1972. B. E. Bykhovskii, editor, p. 186-199. 9 fig., 1 tab., 20 ref. 46 ref.

Descriptors: \*Marine microorganisms, \*Copepods, \*Phylogeny, \*Latitudinal studies,

\*Diets, Oceans, Climatic zones, Ecotypes, Systematics, Crustaceans, Fish food organisms, Distribution.  
Identifiers: \*Calanus, Mandibles.

To determine the presence, degree, and causes of differentiation of mouth parts of a single genus, twelve *Calanus* species were collected from oceans. The masticatory edge of the mandible was examined in each specimen. All species showed asymmetry of form of teeth C-1 and C-2 on both mandibles and of the masticatory edge width. Ventral teeth varied in *Calanus* species collected in different zoogeographic regions. Species from high latitudes in northern and southern hemispheres had two ventral teeth, V-1 and V-2. In species from northern and southern temperate regions, tooth V-2 was only slightly developed or absent, but there was a cuticular tubercle at the base of tooth V-1. Species from tropical regions had a single tooth, V-1. Ventral tooth differences were correlated with differences in dietary composition in different regions. The food consumed was mostly diatoms in higher latitudes, but the proportion of flagellates in phytoplankton and consequently in crustacean diets increased toward the tropics. At the species level, there was a relationship between characteristic features of the range and composition of ventral teeth. Morphological specialization of mandibles in this genus was accompanied by oligomerization of teeth numbers, but this process was apparently not complete in some species. (See also W77-00393) (Buchanan-Davidson-Wisconsin) W77-00396

**SEASONAL CHANGES OF ANTARCTIC PLANKTON IN THE MOLODEZHAYA AND MIRNY REGION.**

Akademiya Nauk SSSR, Leningrad. Zoologicheskii Institut.  
A. Zvereva.

In: Geographic and Seasonal Variability of Marine Plankton, TT-74-50030, 1975. Translated from Izdatelstvo 'Nauka,' Leningradskoe Otdelente, Leningrad, 1972. B. E. Bykhovskii, editor, p. 248-262. 6 fig., 5 tab., 4 ref. 7 ref.

Descriptors: \*Marine microorganisms, \*Temporal distribution, \*Antarctic Ocean, \*Copepods, Zooplankton, Dominant organisms, Period of growth, Varieties.  
Identifiers: \*Mirny Station(Antarctic Ocean), \*Molodezhnaya Station(Antarctic Ocean).

Seasonal changes in Antarctic plankton were studied in samples collected at the Soviet stations of Mirny and Molodezhnaya in 1958 and 1965-1966. Hydrological data and species of copepods found were recorded. In both areas, the most common species found were *Oithona similis*, *Ctenocalanus vanus*, *Oncaea curvata*, *Calanoides acutus*, *Calanus propinquus*, *Stephus longipes*, *Metridia lucens*, and *M. gerlachei* in decreasing numbers. Other species occurred irregularly in small numbers. Immature forms were found in January, and males and females appeared in February-March. In September there was an increase in species diversity and mature individuals. Immature specimens of some species were absent in October, but in some species both immature and mature forms were always present. The Molodezhnaya plankton was richer in species than the Mirny plankton in which *Microcalanus pygmaeus*, *Racovitzanus antarcticus*, *Scaphocalanus brevicornis*, and *Paralabidocera antarctica* were not found. There were peaks of species diversity in January-February and September-October. The September-October peak contained male, female, and copepodid stages IV-V of most species. There was an increase in the volume of plankton/unit water volume in January. The copepod species found at these stations are listed and their maturity, sexual and temporal distribution indicated. (See also W77-00393) (Buchanan-Davidson-Wisconsin) W77-00397

# **BIOLOGICAL SEASONS IN THE ZOOPLANKTON OF DAVIS STRAIT,** Akademiya Nauk SSSR, Leningrad. Zoologicheskii Institut. E. A. Pavshitskii.

In: Geographical and Seasonal Variability of Marine Plankton, TT-74-50030, 1975. Translated from Izdatel'stvo 'Nauka,' Leningradskoe Otdelente, Leningrad, 1972. B. E. Bykhovskii, editor, p. 200-247. 15 fig., 12 tab., 33 ref. 24 ref.

Descriptors: \*Marine microorganisms, \*Seasonal, \*Copepods, \*Biomass, Zooplankton, Biological communities, \*Atlantic Ocean, Arctic Ocean, Ocean currents, Varieties, Fish food organisms, Life cycles, Spawning, Distribution, Canada. Identifiers: \*Davis Strait(North Atlantic Ocean), Irminger current, Calanus finmarchicus, Calanus glacialis.

Zooplankton samples were collected from the Davis Strait bordering Canada's Baffin Island and Greenland, in 1962-1964. In terms of abundance and biomass, Calanus finmarchicus, C. hyperboreus, Metridia longa, Pareuchaeta norvegica, Oithona similis, Oncaea borealis, Thysanoessa longicaudata, Limacina retroversa, and L. helicina were predominant. About 100 other species occurred less frequently and did not appreciably affect seasonal changes in total abundance and biomass. Sometimes Aegagropsis digitata, Ctenophora, larvae of benthic animals, etc. predominated. The continuous presence of C. finmarchicus and Oithona similis indicated the boreal nature of the fauna. Atlantic waters reach the Davis Strait in the Irminger Current which is inhabited by C. finmarchicus and Pareuchaeta norvegica juveniles. Arctic water indicators were C. hyperboreus, Metridia longa, and Limacina helicina. Water temperature fluctuations influenced abundance, biomass, and zooplankton development schedules. Biological seasons started at different times and were of different durations in parts of the strait influenced by different water masses. Ice often interfered with spring spawning processes. The biological season affected planktonic population size more than species composition. Planktonic abundances increased with onset of biological spring and remained relatively unchanged until fall, but relative numbers and biomass of some zooplankton varied. Davis Strait zooplankton showed similarities to fauna of other northern waters influenced by the North Atlantic current. (See also W77-00393) (Buchanan-Davidson-Wisconsin)

W77-00398

## **SPECIES COMPOSITION AND DISTRIBUTION OF ECOLOGICAL COMPLEXES OF ZOOPLANKTON IN THE ENISEI GULF,** Akademiya Nauk SSSR, Leningrad. Zoologicheskii Institut. L. L. Chislenko.

In: Geographical and Seasonal Variability of Marine Plankton, TT-74-50030, 1975. Translated from Izdatel'stvo 'Nauka,' Leningradskoe Otdelente, Leningrad, 1972. B. E. Bykhovskii, editor, p. 275-301. 21 fig., 7 tab., 18 ref.

Descriptors: \*Marine microorganisms, \*Ecological distribution, \*Temporal distribution, \*Zooplankton, Hydrologic properties, Dominant organisms, Biological communities, Saline-freshwater interfaces, Gulfs, Arctic, Biomass. Identifiers: \*Enisei Gulf(Kara Sea).

The ecology and distribution of zooplankton in the Enisei Gulf on the Kara Sea were studied during 1955-1956. Synchronous hydrological determinations were also made. Among the 84 forms found, 70 species were identified: 23 marine species, 7 brackish-water species, and 40 freshwater species. Each form is described and its life stage and response to temperature and salinity recorded. Each zooplankton complex may predominate for a certain time and may be separated from the others vertically and horizontally. The marine complex

consisted mostly of neritic coldwater Arctic species. The Enisei Gulf also contained some oceanic species, especially in the winter. The brackish-water forms were all autochthonous to the brackish Arctic waters; four were endemic to the high Arctic. The freshwater fauna were richest in species but its biomass was much smaller than that of the brackish complex and its existence in the gulf shorter than that of the marine complex. The brackish-water complex was the least diverse qualitatively but predominated quantitatively due to its adaptation to environmental conditions. Zooplankton distribution and development depend largely on hydrologic conditions which vary seasonally and annually. The Enisei Gulf is a typical monocyctic polar water body. The biological fall season is not expressed in the zooplankton. (See also W77-00393) (Buchanan-Davidson-Wisconsin)

W77-00399

## **GEOGRAPHICAL VARIABILITY OF SOME SPECIES OF THE FAMILY OITHONIDAE (COPEPODA, CYCLOPOIDA),** Akademiya Nauk SSSR, Leningrad. Zoologicheskii Institut. V. S. Shuvalov.

In: Geographic and Seasonal Variability of Marine Plankton, TT-74-50030, 1975. Translated from Izdatel'stvo 'Nauka,' Leningradskoe Otdelente, Leningrad, 1972. B. E. Bykhovskii, editor, p. 169-186. 9 fig., 1 tab., 15 ref. 46 ref.

Descriptors: \*Marine microorganisms, \*Geographic regions, \*Copepods, \*Ecological distribution, \*Phylogeny, Oceans, Zooplankton, Ocean currents, Variability, Atlantic Ocean, Arctic Ocean, Tropical regions, Temperate, Ecotypes. Identifiers: \*Oithona similis, Oithona atlantica, Oithona plumifera, White Sea, Sea of Okhotsk, Mediterranean Sea, Gulf of Mexico.

Planktonic organisms can serve as biological indicators of hydrological regimes, water masses, currents, and zoogeographic regions. Variations in body size and morphological characters were measured in Oithona similis, O. atlantica, and O. plumifera collected from different oceans. Two sizes of O. similis were distinguished—a small Atlantic-White Sea group and a large Arctic-Sea of Okhotsk group. Configurations of the rostrum and cephalothorax varied, but not the limbs or armature. Vertical and horizontal size variations occurred due to Arctic water inflow. O. similis lives under a wide range of conditions but is composed of infraspecific forms and groups, each confined to a relatively limited range of factors. O. plumifera and O. atlantica were closely related but independent. O. atlantica was a boreal species inhabiting the North Atlantic, Mediterranean, and northern Gulf of Mexico temperate zones, while O. plumifera was a tropical species. O. atlantica size and antennule length gradually decreased from north to south in the northern hemisphere; this was reversed in the southern hemisphere. O. plumifera varied in hairiness and length of setae on basipodites of the swimming feet, antennules, and furcal rami. Diversity of environmental conditions can cause development of adaptive features in plankton. (See also W77-00393) (Buchanan-Davidson-Wisconsin)

W77-00400

## **INTRASPECIFIC DIFFERENTIATION OF CALANUS PLUMCHRUS MARUKAWA,** Akademiya Nauk SSSR, Leningrad. Zoologicheskii Institut. M. S. Kos.

In: Geographic and Seasonal Variability of Marine Plankton, TT-74-50030, 1975. Translated from Izdatel'stvo 'Nauka,' Leningradskoe Otdelente, Leningrad, 1972. B. E. Bykhovskii, editor, p. 128-168. 28 fig., 5 tab., 63 ref. 46 ref.

Descriptors: \*Marine microorganisms, \*Speciation, \*Phylogeny, \*Copepods, Ecological

distribution, Oceans, \*Pacific Ocean, Animal populations, Systematics, Geographical regions, Seasonal, Ocean currents, Zooplankton, Ecotypes. Identifiers: \*Calanus plumchrus, USSR.

Calanus plumchrus is one of the most abundant and widespread species of copepods in the North Pacific Ocean and the Eastern seas of the USSR. Population analyses were made of over a 1000 specimens from different parts of its range. Twenty-two characters (morphological characteristics, measurements of body parts, etc.) were studied for each specimen. Comparative analysis showed that these characters varied in populations from geographically remote regions but not seasonally in a given region. Significant differences were observed between many of the characters concerning morphological features of females and, to a lesser extent, males. Comparative morphological analysis of intraspecific variability demonstrated the polymorphism of this species. Intraspecific categories could be detected only in sexually mature forms. The northwestern population was a specific form distinct from the northeastern and northern forms; it had a defined range, and the male, and especially the female, had characteristic structural features. Overlapping of intermediate forms in these ranges never exceeded 25%. Intraspecific differentiation depended mainly on geographic distance, while differences in currents and water mass distribution played smaller roles. The comparatively weak expression of intraspecific differentiation in C. plumchrus was attributed to the relative homogeneity of the hydrological conditions in the North Pacific. (See also W77-00393) (Buchanan-Davidson-Wisconsin)

W77-00401

## **PROXIMATE NUTRITIVE VALUE CHANGES DURING DECOMPOSITION OF SALT MARSH PLANTS,**

Mississippi State Univ., Mississippi State.

A. A. de la Cruz.

Hydrobiologia, Vol. 47, No. 3-4, p. 475-480, 1975. 2 tab., 10 ref. NOAA-SG 2-35362, NSF GA-35715.

Descriptors: \*Halophytes, \*Tidal marshes, \*Productivity, Degradation(Decomposition), Detritus, Proteins, Carbohydrates, \*Decomposing organic matter, Bulrushes, Mississippi, Fibers(Plant), Lipids, Salt marshes. Identifiers: Giant cordgrass, Salt grass.

Caloric and nutritive values were determined for giant cordgrass (Spartina cynosuroides), salt grass (Distichlis spicata), and bulrush (Scirpus americanus), which are the dominant vascular plants in Mississippi coastal tidal marshes, during their decomposition to particulate detritus. Decomposition of materials enclosed in nylon-mesh bags occurred faster when submerged. The combustible organic content (ash-free dry weight) of live young plants was lower than that of adult plants; ash-free values of detritus were 63-72% of live plant values. Caloric values of detritus increased slightly. Crude fiber, carbohydrate, and fat contents declined in the detritus. Protein increased in detritus by as much as 96% in Scirpus, 99% in Spartina, and 300% in Distichlis. Marsh plant detritus is a nutritional source of food for estuarine consumers and may be even nutritionally higher than live plants, since they contain less indigestible crude fiber and cellulose. Absorption and/or adsorption of dissolved nutrients to decaying plant matter enhances retention of relatively high organic concentrations, leading to protein and energy retention or increase in the particulate detritus. (Buchanan-Davidson-Wisconsin)

W77-00402

## **EFFECT OF THE DISCHARGE WATERS OF THE TRIPOL'E THERMAL ELECTRIC STA-**

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5C—Effects Of Pollution

**TION OF THE THERMAL REGIME OF THE DNEIPER, (IN RUSSIAN),**  
Akademiya Nauk SSSR, Leningrad. Instytut Hidrobiologii.  
N. V. Pikush.  
Gidrobiol Zh. 11(1), p 79-81, 1975.

Descriptors: Rivers, \*Thermal powerplants, \*Thermal pollution, Heated water, Water pollution sources, Effluents, Mixing, Regime, Cooling water.  
Identifiers: \*Dnieper River, Electric, \*USSR, Waters.

Ten hydrothermal surveys were carried out in 1970-1972 on the Dnieper River (USSR) from 3 km above the Tripol'e thermal electric station to 120 km downstream from it. During the 1st 3 yr of operation the average daily discharge of heated waters varied from 8.3-53.4 m<sup>3</sup>/s and the discharge in the Dnieper varied within 500-18,400 m<sup>3</sup>/s. As a consequence of this variation mixing and cooling occurred at different distances from the discharge point.—Copyright 1976, Biological Abstracts, Inc. W77-00408

**THE EFFECT OF HUMANS ON BIOGEOCENOSIS AND ENVIRONMENTAL PROTECTION, (IN RUSSIAN),**  
For primary bibliographic entry see Field 6G.  
W77-00412

**LARVAL POPULATIONS OF CHIRONOMIDAE IN THE PERIPHYTON OF THE YUGOSLAV PART OF THE DANUBE BETWEEN BIOGRAD AND TEKJA, (IN GERMAN),**  
Institute for Biological Research, Belgrade (Yugoslavia).  
M. Jankovic.  
Arch Hydrobiol Supplementb. 44(4), p 515-524, 1975.

Descriptors: \*Diptera, Aquatic populations, \*Larvae, \*Periphyton, Europe, Rivers.  
Identifiers: \*Cricotopus-Silvestris, \*Danube River, \*Polypedilum-Convictum, Tekija, \*Yugoslavia, Biograd.

In the periphyton 25 spp. or forms of Chironomidae were recorded, but the basic species complex consists of only 9 spp. The most frequent species is Cricotopus silvestris and the leading species in production is Polypedilum gr. convictum.—Copyright 1976, Biological Abstracts, Inc. W77-00413

**CHANGES IN THE CHIRONOMID FAUNA CAUSED BY DAMMING THE DANUBE, (IN GERMAN),**  
Institute for Biological Research, Belgrade (Yugoslavia).  
M. Jankovic.  
Arch Hydrobiol Supplementb. 44(4), p 462-479, 1975.

Descriptors: \*Sampling, \*Reservoirs, Aquatic fauna, Population, \*Plant populations, \*Diptera, \*Post-impoundment.  
Identifiers: Chironomus-plummosus, Chironomus-thummi-F-fluviatilis, Crypto-chironomus, \*Danube River, \*Yugoslavia.

Out of 29 spp. that occurred in the Danube, only 15 were found in the Djerdap Reservoir (Yugoslavia). The rheophilous forms disappeared first, primarily the scarce psammophilous and lithophilous species. Most Chironomidae are lacustrine and mainly pelophilous species. Intensive development of Chironomus f. l. plummosus was observed. In contrast, C.f. thummi f. fluviatilis decreases gradually in number parallel to the diminishing flow in the basin.—Copyright 1976, Biological Abstracts, Inc.

W77-00414

**COMPARATIVE STUDIES ON THE ACTION OF CHLORINE AND OZONE ON POLIOVIRUSES IN THE REPROCESSING OF DRINKING WATER IN ESSEN, (IN GERMAN),**  
Essen Univ. (Gesamthochschule) (West Germany). Abteilung fuer Medizinische Virologie und Immunologie.  
For primary bibliographic entry see Field 5F.  
W77-00419

**THE NUTRIENTS AND PLANTS OF LAKE JOONDALUP, A MILDLY EUTROPHIC LAKE EXPERIENCING LARGE SEASONAL CHANGES IN VOLUME,**  
Western Australia Univ., Nedlands. Dept. of Botany.  
R. A. Congdon, and A. J. McComb.  
Journal of the Royal Society of Western Australia, Vol 59 Part 1, p 14-23, May 1976. 11 fig, 3 tab, 24 ref.

Descriptors: \*Lakes, \*Lake shores, \*Eutrophication, \*E-saline studies, \*Algae, Urbanization, Water chemistry, Aquatic productivity, Primary productivity, Trophic level, \*Nutrients, Nitrogen, Phosphorus, Seasonal, Vegetation, \*Australia, Aquatic plants, Water pollution effects.  
Identifiers: \*Lake Joondalup(W.A.).

Lake Joondalup is one of a chain of lakes to the north of Perth, Western Australia, in a calcareous stable dune system 6 km from the ocean. The region is subject to rapid urbanization and development. A study was undertaken to record the seasonal fluctuations in nutrients and algal density of the lake, with a description of the fringing vegetation, to provide a reference against which future changes may be assessed. Cation ratios in the lake resemble seawater apart from relatively high calcium; seasonal changes in water volume greatly affect ionic concentration. A bloom of the green alga Dispora coincides with low volume and high ion levels. Total nitrogen is high compared to phosphorus, and the data give indications that phosphorus levels may limit algal productivity in the lake. (CSIRO)  
W77-00442

**YELLOW SUBSTANCE (GELBSTOFF) AND ITS CONTRIBUTION TO THE ATTENUATION OF PHOTOSYNTHETICALLY ACTIVE RADIATION IN SOME INLAND AND COASTAL SOUTH-EASTERN AUSTRALIAN WATERS,**  
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Plant Industry.  
J. T. O. Kirk.  
Australian Journal of Marine and Freshwater Research, Vol. 27, No. 1, p 61-71, March 1976. 4 fig, 3 tab, 17 ref.

Descriptors: \*Pigments, \*Light penetration, \*Photosynthesis, Aquatic environment, \*Australia, Freshwater, Sea water, Light quality, Lakes, Reservoirs, Bays, Rivers, Water pollution effects.  
Identifiers: Lake Ginninderra(A.C.T.), Lake Burley Griffin(A.C.T.), Lake George(N.S.W.), Cotter Dam(A.C.T.), Burrinjuck Dam(N.S.W.), Clyde River(N.S.W.), Bateman's Bay(N.S.W.), \*Gelbstoff.

The absorption spectra relative to distilled water of samples from various inland and coastal waters in south-eastern Australia (lake, reservoir, river and bay) have been measured. Amongst the freshwater samples the level of dissolved yellow substance (gelbstoff) was found to vary seven-fold; in coastal water the concentration was much lower than in any of the freshwater samples. In the inland waters yellow substance has a dominating influence on light penetration, and the blue region of

the spectrum is abolished at quite moderate depths. In all cases except seawater it was calculated that most of the quanta captured are absorbed by yellow substance rather than by water. An alternative name, gilvin, is suggested for the yellow pigments in natural waters. (CSIRO)  
W77-00448

**NUTRIENT STATUS OF THE SEDIMENTS IN LAKE MULWALA, 1. TOTAL PHOSPHORUS,**  
Caulfield Inst. of Tech. (Australia). Dept. of Chemistry.  
B. T. Hart, R. J. McGregor, and W. S. Perriman.  
Australian Journal of Marine and Freshwater Research, Vol 27, No. 1, p 129-135, March 1976. 1 fig., 3 tab., 18 ref.

Descriptors: \*Phosphorus, \*Lake sediments, \*Australia, \*Nutrients, Lakes, Urbanization, Eutrophication, Water pollution effects.  
Identifiers: Lake Mulwala(N.S.W.-Vic.).

Chemical analyses are reported for sediment samples taken from Lake Mulwala, a man-made lake in the River Murray (Australia), downstream from a proposed area of urban growth. The sediments are non-calcareous and high in clay content. Total phosphorus levels were found to be of the same order of magnitude as values reported for eutrophic lakes in other countries. Statistical analysis of the data has allowed the calculation of a predictive model for total phosphorus levels in the lake sediments. Total phosphorus was found to be influenced by location within the lake, organic content of the sediments and water depth. On the basis of total phosphorus levels, the lake can be divided into two regions - an upper region influenced by the two input rivers, which has lower levels of total phosphorus, and a lower region with higher levels of sediment phosphorus. It appears that about 50% of this total phosphorus is potentially available for exchange with the water column. (CSIRO)  
W77-00450

**NUTRIENT ECONOMIES AND TROPIC STATUS OF LAKES SORELL AND CRESCENT, TASMANIA (AUSTRALIA),**  
Tasmania Univ., Hobart (Australia). Dept. of Botany.  
D. M. H. Cheng, and P. A. Tyler.  
Australian Journal of Marine and Freshwater Research, Vol 27, No 1, p 151-163, March 1976. 3 fig, 7 tab, 15 ref.

Descriptors: \*Nutrients, \*Lakes, \*Australia, \*Triton, \*Eutrophication, Algae, Phytoplankton, Primary productivity, Nitrogen, Phosphorus, Silicates, Carbonates, Trace elements, Watershed management, Recreation, \*Trophic level, Water pollution effects.  
Identifiers: Lake Sorell(Tas), Lake Crescent(Tas), Tasmania.

Lakes Sorell and Crescent are shallow, polymictic, connected lakes with fundamentally similar physicochemical limnology, but markedly contrasting algal populations and phytoplankton biomass. Investigations are described which sought an explanation in terms of nutrient economies for the biotic contrast. The effects of nutrient enrichment with nitrogen, phosphorus, carbonate, silicate, trace elements and chelates, and of triton removal, on Carbon-14 uptake in incubated samples were determined. It is concluded that the greater productivity and greater plankton biomass of Lake Crescent rests on its greater triton load, derived from greater scouring of sediments, its flow through from Lake Sorell and an abundant fringing marshland. It is likely that the distinctive floras of the two lakes are adapted to the different nutrient conditions, so that flow-through inocula of Lake Sorell algae cannot become established in Lake Crescent. As the lakes are already mesotrophic and eutrophic respectively, management plans for this recreational area should seek to limit nutrient inputs. (CSIRO)



W77-00451

**HYGIENIC ASPECTS OF MICROBIAL CONTAMINATION OF WATER BASINS, (IN RUSSIAN).**

Institute of General and Municipal Hygiene, Moscow (USSR).

For primary bibliographic entry see Field 5B.

W77-00454

**IDENTIFICATION OF TWO CHLORINATED GUAIACOLS IN KRAFT BLEACHING WASTE-WATERS,**

Fisheries and Marine Service, West Vancouver (British Columbia). Pacific Environment Inst.

For primary bibliographic entry see Field 5A.

W77-00459

**NATIONAL CONFERENCE ON POLYCHLORINATED BIPHENYLS (NOVEMBER 19-21, 1975, CHICAGO, ILLINOIS), PROCEEDINGS.**

Environmental Protection Agency, Washington, D. C. Office of Toxic Substances.

For primary bibliographic entry see Field 5B.

W77-00460

**CONSUMPTION OF ORGANIC MATTER OF MUDS BY ILYOCRYPTUS SORDIDUS (CLADOCERA, MACROTHRICIDAE), (IN RUSSIAN).**

Akademiya Nauk SSSR, Moscow. Institut Biologii Vnutrennykh Vod.

Z. N. Chirkova, and V. I. Romanenko.

Gidrobiol Zh. 9(5), p 63-67, 1973.

Descriptors: \*Reservoirs, \*Bottom sediments, Feeding rates, \*Biomass, \*Organic matter, Sands, Mud, Silts, \*Crustaceans, Lake sediments.

Identifiers: \*Ilyocryptus-Sordidus, Macrothricidae, USSR, Rybinsk reservoir, Volga.

Aquarium experiments with *Ilyocryptus sordidus* on gray, peaty and sandy muds and pure sand collected from various places of the Rybinsk reservoir on the Volga (USSR) showed that the nonuniform distribution of the cladoceran in the reservoir is due to the food value of the bottom deposits. The main factor limiting the distribution of *I. sordidus* in the reservoir is the weak silting of the flooded soils and the low content of organic matter on the slightly silted areas. When calculating the intensity of feeding and biomass production of *Ilyocryptus*, (as much as 99% of the total number of cladocerans of the family Macrothricidae), it is necessary to consider the character of the bottom deposits and their organic matter content.—Copyright 1975, Biological Abstracts, Inc.

W77-00507

**POTAMOGETON PERFOLIATUS IN A BRACKISH-WATER ESTUARY AT ORA, FREDRIKSTAD (S. NORWAY), (IN NORWEGIAN).**

Norsk Institutt for Vannforskning, Blindern.

B. Rorslett.

Blyttia. 33(2), p 69-82, 1975.

Descriptors: \*Estuaries, Salinity, Vegetation, \*Brackish water, Analysis, Remote sensing, Eutrophication, Water pollution effects.

Identifiers: \*Fauna, \*Flora, Fredrikstad, \*Norway(Orsa Estuary), \*Potamogeton Perfoliatus, Ruppia.

The River Glama estuary at Fredrikstad, S Norway has a rich flora and fauna. The brackish-water area contains a mixture of marine and freshwater species. A municipal land-reclamation project carried out about 1970 has markedly influenced the salinity of the Orsa estuary. A general increase in the salinity level has led to vegetational changes.

The submergent freshwater species *P. perfoliatus*, formerly abundant in the estuary, is rapidly disappearing, being replaced by the salinity-tolerant *Ruppia*. Remote sensing imagery acquired by IR falsecolor films and multispectral camera was used to map the present distribution of *P. perfoliatus* in the estuarine region. The colony pattern and development could be analyzed on the imagery. A gradual breakdown of the Potamogeton population by increasing salinity was demonstrated. In laboratory experiments, the salinity tolerance of *P. perfoliatus* was lower than 90%. Salinity values exceeding the tolerance level of *P. perfoliatus* are now frequently found in the estuarine waters.—Copyright 1975, Biological Abstracts, Inc.

W77-00508

**SEASONAL SUCCESSION AND VERTICAL DISTRIBUTION OF PHYTOPLANKTON IN LAKE HAYES AND LAKE JOHNSON, SOUTH ISLAND, NEW ZEALAND,**

Otago Univ., Dunedin (New Zealand). Dept. of Zoology.

Carolyn W. Burns, and S. F. Mitchell.

N Z J Mar Freshwater Res. 8(1), p 167-209, 1974.

Descriptors: \*Lakes, \*Australia, Algae, \*Phytoplankton, Plankton, Diatoms, Chlorophyta, \*Plant populations, Eutrophication, Water pollution effects.

Identifiers: *Anabaena-flos-aquae*, *Closterium-aciculare*, *Closterium-acutum-var-variabile*, *Cryptomonas*, *Cyclotella-kuetzingiana*, *Hayes Lake*, *Melosira-granulata*, \*New Zealand, *Peridinium-cinctum*, *Staurastrum-bibrachiatum*, *Staurastrum-Spp.*

In 2 small monomictic lakes near Queenstown, South Island, New Zealand, algal associations characteristic of eutrophic waters were present throughout most of the period from Dec. 1969-Feb. 1972. *Melosira granulata* dominated the plankton in winter; at other times of the year *Closterium aciculare*, *Cyclotella kuetzingiana*, and *Staurastrum spp.* were dominant. In Lake Johnson, the major algae differed from 1 yr to another. Blooms of *A. flos-aquae* formed during the 1st two summers but were absent in the third, when *Closterium acutum var. variabile* was dominant. *Peridinium cinctum* was abundant throughout the 1st yr, especially in December 1969 and October 1970, when concentrations of more than 1000 cells/ml occurred at the surface. During autumn and winter of the 2nd yr, *S. bibrachiatum* dominated the plankton. In both lakes, micro-algae were abundant in late spring and early summer. In winter, when the lakes were isothermal, algae were distributed fairly uniformly with depth. During the period of thermal stratification, algae were mainly confined to the epilimnion. Although green algae and diatoms were usually dispersed fairly uniformly throughout this zone, *Cryptomonas* and *Peridinium* were often concentrated at a certain depth. In Lake Johnson in late summer 1971, a layer of purple photosynthetic bacteria, of which concentrations of 0.5-1.3 x 10<sup>6</sup> cells/ml were recorded, was present at a depth of 7-8 m. The mean standing crop of algae for the trophogenic zone of Lake Hayes was 6000 cells/ml, and a maximum crop of 65,000 cells/ml was recorded in December 1971 during an *Anabaena* bloom: the mean volume of phytoplankton was 1.93 mm<sup>3</sup> per litre for the trophogenic zone with a maximum of 7.49 mm<sup>3</sup>/l in Jan. 1970 when *Anabaena* and *Peridinium* were abundant. In Lake Johnson, the mean number of algae in the trophogenic zone was 11,000 cells/ml and the mean volume of phytoplankton was 9.37 mm<sup>3</sup>/l: a maximum volume of 33.12 mm<sup>3</sup>/l was recorded in Oct. 1970 when *Peridinium* was abundant. Copyright 1975, Biological Abstracts, Inc.

W77-00517

**5D. Waste Treatment Processes****THE EFFECTS OF VARIOUS TERTIARY TREATMENT NUTRIENT REMOVAL SCHEMES ON PERIPHYTON COMMUNITIES IN MODEL LABORATORY STREAMS,**

Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.

For primary bibliographic entry see Field 5C.

W77-00005

**PROCEEDINGS OF THE 1975 NATIONAL CONFERENCE ON MUNICIPAL SLUDGE MANAGEMENT AND DISPOSAL.**

Environmental Protection Agency, Washington, D. C. Office of Research and Development.

August 18-20, 1975, Held at Anaheim, California, 257 p. Published in 1975 by Information Transfer, Inc., Rockville, Md.

Descriptors: \*Waste water treatment, \*Pollutant identification, \*Treatment facilities, \*Conferences, \*Municipal wastes, \*Sludge disposal, \*Sludge, Management.

Various aspects of sludge treatment and disposal are discussed. Sludge disposal alternatives are considered for Philadelphia, Boston, Denver, and cities in general. The previous year's conference is updated, and another seminar is summarized. The disposal methods discussed include burning and disposal onto land. The discussion of land disposal includes its effects on plants, groundwater, and human health and its use in soil stabilization and improvement. Sludge digestion and treatment are also discussed. The treatment methods include the use of high energy radiation, heat drying, and composting. Other topics discussed include institutional problems of small treatment plants, a computer program to evaluate sludge handling and disposal costs, and energy conservation practices in municipal sludge management. (See W77-00010 thru W77-00038) (Snyder-FIRL)

W77-00009

**INSTITUTIONAL PROBLEMS OF THE SMALL TREATMENT PLANT,**

Environmental Quality Systems, Inc., Rockville, Md.

E. J. Martin, R. DuBois, and H. Bernard.

In: Proceedings of the 1975 National Conference on Municipal Sludge Management and Disposal, August 18-20, 1975, Anaheim, California, p 23-25.

4 tab.

Descriptors: \*Treatment facilities, \*Waste water treatment, \*Municipal wastes, \*Sludge treatment, \*Institutional constraints, Economics, Design criteria, Activated sludge, Waste treatment, Cities, Legislation.

Problems associated with the design of small municipal waste water treatment plants are discussed, with a specific example being described. The example involves the design of a 6 million gallon/day activated sludge treatment plant which subsequently failed to meet state and Federal requirements despite original projections for future capacity needs and legislative changes. Problems encountered with the plant included: no replication of sludge handling equipment, inadequate storage and sludge thickening, makeshift sludge transfer, questionable sludge filter capacity, the use of an activated sludge system for solids storage, and various difficulties associated with a heat treatment unit. Conflicting requirements between the city's ability to comply in terms of financial resources and state and Federal demands for upgrading are discussed. (See also W77-00009) (Kreager-FIRL)

W77-00010

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5D—Waste Treatment Processes

**REGIONAL WASTEWATER SOLIDS MANAGEMENT PROGRAM LOS ANGELES-ORANGE COUNTY METROPOLITAN AREA,**  
Los Angeles-Orange County Sludge Program, Whittier, Calif.  
For primary bibliographic entry see Field 5E.  
W77-00011

**COMPUTER EVALUATION OF SLUDGE HANDLING AND DISPOSAL COSTS,**  
Municipal Environmental Research Lab., Cincinnati, Ohio.  
R. Smith, and R. G. Eilers.  
In: Proceedings of the 1975 National Conference on Municipal Sludge Management and Disposal, August 18-20, 1975, Anaheim, California, p 30-59. 13 fig, 6 tab, 20 ref.

Descriptors: \*Sludge treatment, \*Sludge disposal, \*Computer programs, \*Municipal wastes, \*Cost-benefit analysis, Management, Programs, Performance, Evaluation, Treatment facilities, Waste water treatment, Operating costs.

A digital computer program which is capable of examining the cost and performance of a wide variety of alternative sludge handling schemes for municipal waste water treatment plants is described. The basic computational program is known as the Executive program and contains a subroutine for each of the liquid and sludge treatment alternatives. It also contains rate and mass balance relationships necessary to generate the effluent stream vectors when one or more influent stream vectors are supplied together with certain decision variables. The subroutine sizes all structures and equipment and estimates the capital, operating, and maintenance costs associated with the process. The capability of the program is demonstrated for 261 alternative sludge treatment and disposal schemes. The program is designed to be used as a management tool to narrow the range of sludge treatment and disposal options when the site-specific conditions are known. (See also W77-00009) (Kreager-FIRL)  
W77-00012

**URBAN SLUDGE DISPOSAL OR UTILIZATION ALTERNATIVES, SOCIO-ECONOMIC FACTORS,**  
Environmental Protection Agency, Philadelphia, Pa. Region III.  
For primary bibliographic entry see Field 5E.  
W77-00013

**SLUDGE MANAGEMENT ALTERNATIVES FOR COASTAL CITIES,**  
Engineering-Science, Inc., Berkeley, Calif.  
For primary bibliographic entry see Field 5E.  
W77-00014

**BY-PRODUCT SOLIDS MANAGEMENT ALTERNATIVES CONSIDERED FOR PHILADELPHIA,**  
Greeley and Hansen, Chicago, Ill.  
For primary bibliographic entry see Field 5E.  
W77-00015

**SLUDGE DISPOSAL ALTERNATIVES FOR BOSTON,**  
Havens and Emerson Ltd., Cleveland, Ohio.  
For primary bibliographic entry see Field 5E.  
W77-00016

**ALTERNATIVES FOR DISPOSAL FOR THE METROPOLITAN DENVER SEWAGE DISPOSAL DISTRICT NO. 1,**  
Metropolitan Denver Sewage Disposal District Number 1, Commerce City, Colo.  
For primary bibliographic entry see Field 5E.  
W77-00017

**ENERGY CONSERVATION PRACTICES IN MUNICIPAL SLUDGE MANAGEMENT,**  
Public Technology, Inc., Washington, D. C.  
G. W. Miller.  
In: Proceedings of the 1975 National Conference on Municipal Sludge Management and Disposal, August 18-20, 1975, Anaheim, California p 91-100. 2 fig, 6 tab, 21 ref.

Descriptors: \*Sludge treatment, \*Waste water treatment, \*Municipal wastes, \*Cost analysis, \*Digestion, Byproducts, Incineration, Conservation, Methane, Energy conversion, Treatment facilities.

Municipal inventories of energy consumption associated with waste watertreatment sludge management are reviewed in relation to conserving energy in such operations. Energy consumption in waste water treatment operations in general and for sludge disposal in particular is concluded to be a major consumer in municipal government operations. Larger waste water treatment plants that process sludge by anaerobic digestion can increase the cost-effectiveness of their operations by utilizing all of the digester gas. The digester gas can be used directly to operate equipment, can be used to generate electricity, or can be sold for commercial or industrial use. It is usually not practical to sell methane gas produced by digestion if it is possible to utilize all of it within the plant. A detailed cost analysis of the value of retaining digestion when total incineration of raw sludge is possible is presented for a particular facility. (See also W77-00009) (Kreager-FIRL)  
W77-00018

**UPDATING THE 1974 PITTSBURGH CONFERENCE,**  
Environmental Protection Agency, Washington, D. C.  
D. R. Wright.  
In: Proceedings of the 1975 National Conference on Municipal Sludge Management and Disposal, August 18-20, 1975, Anaheim, California, p 101-108.

Descriptors: \*Municipal wastes, \*Waste water treatment, \*Sludge treatment, \*Sludge disposal, Incineration, Dewatering, Filtration, Digestion, Sewage sludge, Irrigation, Economics, Conservation, Recycling, Treatment facilities, Fertilizers, Drying.

Summaries of various projects dealing with municipal waste water and sludge treatment are presented. Specific projects discussed include: studies on the interactions between sludge thickening and other sludge treatment and disposal processes; anaerobic digester operation; a comparison of diffused air aerobic digestion with pure oxygen digestion waste activated sludge the use of pressure filtration of solids removal; the effectiveness of combining heat treatment, dewatering, and incineration for sludge treatment and disposal; the drying of sludge for marketing as fertilizer; the utilization of digested chemical sewage sludge on agricultural lands; the economics of sludge irrigation; and energy conservation and recycling techniques for waste water treatment plants. (See also W77-00009) (Kreager-FIRL)  
W77-00019

**SUMMARY OF THE ASCE SEMINAR ON SLUDGE DISPOSAL,**  
MCA Engineering Corp., Baltimore, Md.  
C. M. Robson.  
In: Proceedings of the 1975 National Conference on Municipal Sludge Management and Disposal, August 18-20, 1975, Anaheim, California, p 109-114. 6 tab, 1 ref.

Descriptors: \*Sludge treatment, \*Sludge disposal, \*Municipal wastes, \*Reclamation, Conservation, Land use, Waste disposal.

Summaries of presentations dealing with sludge treatment and disposal delivered at the Second Annual National Conference on Environmental Engineering Research, Development, and Design sponsored by the American Society of Chemical Engineers at the University of Florida on July 21, 1975 are presented. Topics covered include: an overview of sludge handling and disposal, the treatment of sludge processing sidestreams, methods for conserving energy during sludge incineration, the landspreading of liquid municipal sludge, and the treatment of sludge for land disposal. Each summary is supplemented by information provided during subsequent question and answer periods. (See also W77-00009) (Kreager-FIRL)  
W77-00020

**THE PAST, PRESENT, AND FUTURE PROSPECTS OF BURNING MUNICIPAL SEWAGE SLUDGE ALONG WITH MIXED MUNICIPAL REFUSE,**  
Weston (Roy F.) Inc., West Chester, Pa.  
For primary bibliographic entry see Field 5E.  
W77-00021

**HIGH ENERGY RADIATION IN SLUDGE TREATMENT - STATUS AND PROSPECTS,**  
Environmental Protection Agency, Cincinnati, Ohio.  
J. B. Farrell.  
In: Proceedings of the 1975 National Conference on Municipal Sludge Management and Disposal, August 18-20, 1975, Anaheim, California, p 124-133. 6 fig, 3 tab, 21 ref.

Descriptors: \*Radiation, \*Waste water treatment, \*Sludge treatment, \*Sewage, Microorganisms, Chemical oxygen demand, Economics, Chlorine, Oxygen, Heat, Waste treatment, Sewage sludge, Chlorides, \*Radiation.

The use of high energy radiation for treating waste water and sewage sludge is discussed in terms of past experience and future prospects. Experimental work with sewage sludge indicates that highly significant levels of microbial reduction occur at irradiation levels under 1.0 megarad. Cost studies indicate unrealistically high levels for sewage treatment but not necessarily for sludge. Synergistic effects on reductions in microbial levels appear to occur when radiation is combined with chlorine, heat, or zinc chloride. Radiation also reduces the chemical oxygen demand levels for aqueous solutions of certain chemicals at radiation levels less than 0.2 megarad, but much higher levels are required for significant effects with sewage. Radiation treatment apparently improves the settling rate and filterability of sewage sludge, although the effect is not large. Future prospects for improving radiation effectiveness hinge around the effect of oxygen addition, although this approach may be limited by the solubility of oxygen in sludge. There is also the possibility of irradiating raw sludge for subsequent disposal into the ocean or for landspreading purposes. Major research programs dealing with radiation treatment of wastes are outlined. (See also W77-00009) (Kreager-FIRL)  
W77-00022

**MANAGEMENT OF MUNICIPAL WASTE-WATER TREATMENT RESIDUALS,**  
National Science Foundation, Washington, D. C.  
E. H. Bryan.  
In: Proceedings of the 1975 National Conference on Municipal Sludge Management and Disposal, August 18-20, 1975, Anaheim, California, p 134-138.

Descriptors: \*Waste water treatment, \*Sludge treatment, \*Research priorities, \*Municipal wastes, Model studies, Injection wells, Radiation, Viruses, Nutrients, Management, Simulation analysis, Domestic wastes, Industrial wastes, Economics, Land use.

Research projects sponsored by the National Science Foundation and dealing with the management of municipal waste water treatment residuals are reviewed. The projects involve the following: the design of a tractor-implement for injecting sludge into soil at a rate of up to 800 gallons/minute; the development of an analytical model of subsurface injection; the potential use of high-energy electrons for the disinfection of municipal waste water treatment residuals; the extent of virus survival in soils subjected to municipal sludge application; the control of virus pathogens by irradiation; the process selection for optimum management of regional waste water treatment residuals; the potential utilization of wetlands for their ability to remove nutrients from domestic waste water that has received secondary treatment; the use of simulation to provide a better understanding of water, nutrient, and general ecosystem functions; the use of injection wells for industrial waste management; and the relationships between regionalization of waste water systems and economies of scale. (See also W77-00009) (Kreager-FIRL)

W77-00023

**PYROLYSIS OF SEWAGE SLUDGE,**  
Environmental Protection Agency, Cincinnati, Ohio.

For primary bibliographic entry see Field 5E.  
W77-00024

**SLUDGE PYROLYSIS FOR ENERGY RECOVERY AND POLLUTION CONTROL,**  
Stanford Research Inst., Menlo Park, Calif.  
For primary bibliographic entry see Field 5E.  
W77-00025

**A SLUDGE POLICY FOR THE 70'S,**  
Environmental Protection Agency, San Francisco, Calif. Region IX.  
For primary bibliographic entry see Field 5E.  
W77-00026

**ECOLOGICAL IMPACT OF THE DISPOSAL OF MUNICIPAL SLUDGE ONTO LAND,**  
McCormick (Jack) and Associates, Inc., Devon, Pa.  
For primary bibliographic entry see Field 5E.  
W77-00027

**PLANT UPTAKE OF HEAVY METALS FROM SEWAGE SLUDGE APPLIED TO LAND,**  
Department of Agriculture, Beltsville, Md.  
R. L. Chaney, M. C. White, and P. W. Simon.  
In: Proceedings of the 1975 National Conference on Municipal Sludge Management and Disposal, August 18-20, 1975, Anaheim, California, p 169-178. 7 fig, 10 tab, 31 ref.

Descriptors: \*Sludge disposal, \*Plant tissues, \*Heavy metals, \*Food chains, \*Cadmium, \*Toxicity, Soil analysis, Soil chemistry, Soil treatment, Zinc.  
Identifiers: Composting.

Field and greenhouse experiments with sludge and composted sludge as well as studies involving the analysis of sludges currently applied to agricultural land conducted to investigate potential hazards associated with heavy metal uptake by plants. The results indicated that composting reduced the sludge metal availability to plants in addition to being desirable from the standpoint of pathogen reduction, odor control, drying, and ease of handling. Composting also generally produced a material which initially raised the soil pH and did not cause as much subsequent slow lowering of soil pH as digested sludge did. Plant cadmium uptake was extremely complex, depending on such factors as soil cadmium level, soil pH, the levels of other heavy metals in the soil, plant species and variety, and temperature. The experimental results

indicate that the food chain should be adequately protected from sludge-borne cadmium if sludge use on cropland is restricted to only those sludges with a cadmium level equal to or less than 1% of the zinc content. (See also W77-00009) (Kreager-FIRL)

W77-00028

**EFFECTS OF SEWAGE SLUDGE OR EFFLUENT APPLICATION TO SOIL ON THE MOVEMENT OF NITROGEN, PHOSPHORUS, SOLUBLE SALTS AND TRACE ELEMENTS TO GROUNDWATERS,**  
California Univ., Riverside. Dept. of Soil Science and Agricultural Engineering.  
For primary bibliographic entry see Field 5C.  
W77-00029

**ENVIRONMENTAL EFFECTS OF SLUDGE DISPOSAL IN SANITARY LANDFILLS,**  
Environmental Protection Agency, Washington, D. C.  
For primary bibliographic entry see Field 5C.  
W77-00030

**IMPACT OF LAND DISPOSAL OF SLUDGES ON GROUNDWATER,**  
Geraghty and Miller. Port Washington, N. Y.  
For primary bibliographic entry see Field 5B.  
W77-00031

**ENGINEERING STUDY AND FIELD DEMONSTRATION TRIALS FOR SAND DUNE STABILIZATION,**  
Ward (George D.) and Associates, Portland, Ore.  
For primary bibliographic entry see Field 5E.  
W77-00032

**POTENTIAL HEALTH IMPACTS OF SLUDGE DISPOSAL ON THE LAND,**  
Environmental Protection Agency, Research Triangle Park, N. C.  
For primary bibliographic entry see Field 5C.  
W77-00033

**FDA'S OVERVIEW OF THE POTENTIAL HEALTH HAZARDS ASSOCIATED WITH THE LAND APPLICATION OF MUNICIPAL WASTE-WATER SLUDGES,**  
Food and Drug Administration, Washington, D. C.  
For primary bibliographic entry see Field 5E.  
W77-00034

**A SUMMARY OF OBSERVATIONS ON THERMOPHILIC DIGESTER OPERATIONS,**  
Los Angeles Sanitation Bureau, Playa del Rey, Calif. Hyperion Treatment Plant.  
G. T. Ohara, and J. E. Colbaugh.  
In: Proceedings of the 1975 National Conference on Municipal Sludge Management and Disposal, August 18-20, 1975, Anaheim, California, p 218-226. 10 fig, 9 tab, 4 ref.

Descriptors: \*Waste water treatment, \*Chemical oxygen demand, \*Treatment facilities, \*Sludge digestion, \*Thermophilic bacteria, Investigations, Dewatering, Methane.  
Identifiers: \*Thermophilic digestion.

Observations made while investigating two applications of the thermophilic sludge digestion are reported. The applications concern the enhancement of the sludge dewatering process under certain conditions when thermophilically digested sludge is used instead of mesophilically digested sludge and methane gas production during thermophilic digestion in comparison to mesophilic digestion. The investigations were conducted at a Los Angeles treatment plant. Thermophilically digested sludge and a solid bowl centrifuge produced a drier sludge cake, contained less suspended material in

the centrate, required less chemical conditions than mesophilic sludge, and permitted a higher sludge feed rate. This combination was the only one to essentially meet all the dewatering requirements. Heating digesters to 120 F for thermophilic digestion requires 69% more BTUs than heating them to 95 F for mesophilic digestion. There is some evidence that the centrate from thermophilic sludges contains a greater amount of certain dissolved heavy metals. Also, centrate-filtrate from thermophilic sludges contained approximately 30% higher chemical oxygen demand (COD) than mesophilic centrate. Thermophilic bacteria appear more sensitive to loading and temperature changes than mesophilic bacteria. Thermophilic sludges were easier to dewater in some situations. Thermophilic particles are coarser than mesophilic particles. Volatile acid levels are 400-500 mg/liter in thermophilic digestion, compared to 100-200 mg/liter for mesophilic digestion. There is some evidence that methane gas production is higher and gas quality is lower for thermophilic digestion, when compared to mesophilic digestion. (See also W77-00009) (Snyder-FIRL)

W77-00035

**UTILIZATION OF METHANE FROM SLUDGE DIGESTION,**  
Greeley and Hansen, Chicago, Ill.  
S. K. Kapoor, and D. Newton  
In: Proceedings of the 1975 National Conference on Municipal Sludge Management and Disposal, August 18-20, 1975, Anaheim, California, p 227-234. 3 fig, 1 tab, 27 ref.

Descriptors: \*Waste water treatment, \*Treatment facilities, \*Methane, \*Sludge digestion, Chemicals, Industrial production, Sewage treatment, Economic efficiency, Heating, Storage, Feasibility, Ammonia, Supply.  
Identifiers: Chemical production, Methanol.

Numerous conventional uses of sludge gas are restated and the feasibility of sludge gas utilization for production of chemicals is discussed. It appears that both sludge gas utilization and production should be maximized. Increased energy requirements due to proposed secondary treatment at all plants call for more intensive use of sludge for plant purposes. Historical modes of sludge gas utilization are believed to be the most economical. These include generation of electricity; direct operation of pumps and blowers; and hot water or steam production for space heating, air-conditioning, and digester heating. In-plant storage will help increase utilization by equalizing essentially diurnal fluctuation in supply and demand. In some places, the conventional uses may not be feasible; use of sludge gas to produce ammonia or methanol for in-plant use should be investigated. If applicable, ammonia can be used to fortify sludge for use as soil conditioner or fertilizer. In exceptional cases, sludge gas has been effectively sold to a gas-using industry or utility. Commercial use of sludge gas is likely to become more cost effective as natural gas and other energy sources diminish in supply and become more expensive. (See also W77-00009) (Snyder-FIRL)

W77-00036

**PROCESSING, ECONOMICS AND SALE OF HEAT DRIED SLUDGE,**  
Environmental Protection Agency, Cincinnati, Ohio.  
G. Stern.  
In: Proceedings of the 1975 National Conference on Municipal Sludge Management and Disposal, August 18-20, 1975, Anaheim, California, p 235-244. 4 fig, 7 tab, 34 ref.

Descriptors: \*Waste water treatment, \*Activated sludge, \*Treatment facilities, \*Economics, \*Drying, Municipal wastes, Waste water (Pollution), Heat treatment, Horticulture.



## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5D—Waste Treatment Processes

Heat drying of municipal waste water sludge is reassessed. Undigested sludge can be heat treated to produce a useful product for agriculture and horticulture. Heat drying destroys most of the bacteria. Various types of direct heat dryers can be used. The energy requirements for producing equivalent amounts of nitrogen from sludge or commercial fertilizer can be comparable. While expensive, heat drying can be a relatively cheaper alternative to sludge disposal for many municipalities if the final product can be successfully marketed. Trends indicate that over one-third of the sludge to be produced in 1985 will be waste activated sludge, the kind that has been successfully marketed. Heat dried sludge sales are directed toward four major markets: industrial fertilizer compounds, citrus growers, nursery/horticulture/turf grass markets, and retail sales. Heat dried sludge offers slow-release organic nitrogen, other organics that improve the physical structure of soils, and trace elements such as zinc. Marketing heat dried sludge might best be done by a commercial firm. The rapid increase in commercial fertilizer cost is an added incentive to using heat dried sludge. (See also W77-00009) (Snyder-FIRL) W77-00037

**COMPOSTING RAW SLUDGE,**  
Agricultural Research Service, Beltsville, Md.  
E. Epstein, and G. B. Willson.  
In: Proceedings of the 1975 National Conference on Municipal Sludge Management and Disposal, August 18-20, 1975, Anaheim, California, p 245-248. 2 fig, 2 tab, 8 ref.

Descriptors: \*Treatment facilities, \*Sewage sludge, \*Aeration, \*Air, \*Air circulation, Odor, Gases, Temperature, Monitoring, Sewage treatment, Waste water treatment, Equipment.  
Identifiers: \*Composting, Compost.

Since windrow composting of raw sludge was previously tried and proved unsatisfactory, a forced aeration method was developed. The forced aeration system uses a pile of raw sludge mixed with woodchips or shredded bark to provide bulk. A vacuum is used to draw air through the pile. The pile is covered with finely screened compost from previous operations to prevent odoriferous gases from escaping into the atmosphere. Gases removed from the pile are scrubbed by passing through another pile of screened compost. This method of composting shows promise for controlling the odors associated with windrow composting of raw sewage sludge. The covering of screened compost ensures that all of the raw sludge reaches temperatures above the thermal death point of most pathogens. Measuring temperature and oxygen is the only monitoring required. The method can be adapted readily for use by either large or small sewage treatment plants. It requires only a modest investment in equipment. (See also W77-00009) (Snyder-FIRL) W77-00038

**SLUDGE DRYING BEDS ARE PRACTICAL, PART 1,**  
J. A. Beardsley.  
Water and Sewage Works, Vol. 123, No. 7, p 82-84, July, 1976.

Descriptors: \*Sludge treatment, \*Dewatering, \*Design criteria, \*Drainage systems, Pipelines, Drying, \*Waste treatment, Materials, Performance.

The use of new designs and chemical treatment for reducing the space and labor required by sludge drying beds is discussed. Two distinct improved designs for sludge drying beds are emerging. The first is a full sand bed with the underdrain system improved so that the clay tile is not crushed by the weight of an end loader. Strong perforated plastic drainpipe or some other means can be used to protect the tile from the load. The second design in-

volves alternating sand and cement strips, with the latter being spaced at wheel distances for the end loader. Provisions for draining surface water can be incorporated at intervals in the bed wall so that rainwater or free water released by chemical treatment may be quickly drained off. This is particularly important in modifying existing hard-bottom beds to optimize chemical use. (Kreager-FIRL) W77-00039

**CHEMICAL CHANGES IN THE SOIL SOLUTION FROM A SPodosol IRRIGATED WITH SECONDARY-TREATED SEWAGE EFFLUENT,**  
Florida Agricultural Experiment Station, Gainesville. Soil Science Dept.  
For primary bibliographic entry see Field 5E. W77-00040

**CROSS-FLOW FILTRATION IN PHYSICAL-CHEMICAL TREATMENT OF MUNICIPAL SEWAGE EFFLUENTS,**  
Oak Ridge National Lab., Tenn.  
H. A. Mahlman, W. G. Sisson, K. A. Kraus, and J. S. Johnson, Jr.  
Report EPA-600/2-76-025, February, 1976. 127 p. 54 fig, 11 tab, 38 ref. ORNL/TM-5423.

Descriptors: \*Waste water treatment, \*Sewage treatment, \*Treatment facilities, \*Filtration, \*Activated carbon, Biological treatment, Sewerage, Chemical precipitation, Tertiary treatment, Nutrient removal, Organic matter, Phosphates, Iron, Turbidity.  
Identifiers: Cross-flow filtration.

Exploratory investigations were performed on the use of cross-flow filtration of primary and secondary municipal sewage effluents. In this approach, the solution being filtered is pumped parallel to the filter. Thickening of flux-limiting filtercake is slowed, and the original stream is separated into a large volume of filtrate and a concentrated slurry of solids. The effects of pressure, circulation velocity, additive concentration, water recovery, pH, and other variables were investigated. Filtrate from primary effluent treated with iron or aluminum salts, with powdered activated carbon (PAC), or with both hydrolyzable ions and PAC, was generally of quality superior in turbidity, organic carbon, and other respects to the effluent from biological secondary treatment. Turbidities were usually well below 1 JTU; bacteria were substantially removed. With iron or aluminum salts, filtrate total organic carbon (TOC) typically was 10 to 15 mg/liter, and phosphate below one mg/liter. With PAC, TOC was usually about 5 mg/liter, but phosphate removal was poor. With about 0.001 M iron(III) average fluxes of about 6 m/d appear attainable at 4.6 m/sec circulation velocity with 24 hr backwash intervals. Filtrate cost for a 3,800 cu m/d plant using iron salts was estimated at \$.12/cu m. When feed is activated sludge secondary effluent, fluxes and product characteristics are similar, except that TOC is lower. With iron or aluminum salts, unless pH is adjusted to the neutral range before filtration, filtrate is substantially contaminated with the salts. An effluent low in phosphate and TOC was obtained by second-stage filtration of primary sewage filtrate treated with PAC and hydrolyzable ions. (Snyder-FIRL) W77-00042

**REVIEW OF THE MUNICIPAL WASTE WATER TREATMENT WORKS PROGRAM,**  
Environmental Protection Agency, Washington, D.C. Construction Grants Review Group.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-244 923. Price codes: A05 in paper copy, A01 in microfiche. EPA Miscellaneous Report, November 30, 1974. 93 p, 1 fig, 23 tab, append.

Descriptors: \*Waste water treatment, \*Treatment facilities, \*Waste water(Pollution), \*Waste treatment, \*Programs, Municipal wastes, Grants, Construction.

The grants program for construction of municipal waste water treatment facilities is reviewed. An adequate program is defined. The many requirements were aggregated into the principal goal of achieving the most cost-effective abatement of municipal waste water pollution through the proper planning, design, construction, and operation of treatment works. This goal includes five subgoals: managing the program efficiently and with sufficient resources for adequate performance, ensuring that projects are constructed in a timely manner by expeditiously obligating funds, ensuring the environmental soundness of the projects by managing the environmental impact statement process effectively, detecting and deterring fraud and other irregularities, and protecting the responsibilities of the states in water pollution control. Cost-effectiveness is defined as including social, environmental, and non-monetary costs. One possible strategy summarizes the manpower requirements of the adequate strategy. It would permit a relatively high achievement of the cost-effectiveness goal and its subgoals. A second possible strategy would require less staff but could seriously sacrifice achievement of program goals. Two other possible strategies would reduce federal staffing needs, but would increase those of the states through the delegation of additional responsibilities. (Snyder-FIRL) W77-00043

**REMOVAL VS BENEFITS: IT CAN BE TOO COSTLY,**  
Kansas City Water and Pollution Control Depts., Mo.  
D. R. Boyd, Jr., J. R. Popalisky, J. D. Reece, and D. McMurtrey.  
Water and Wastes Engineering, Vol. 13, No. 2, p 42-44, February, 1976. 4 fig.

Descriptors: \*Sewage treatment, \*Nutrients, \*Waste water treatment, \*Water purification, \*Water quality control, Missouri river, Missouri, Cities, Municipal wastes, Economics, Treatment facilities.

Complete nutrient removal at sewage treatment facilities discharging to the Missouri River is discussed in terms of the resulting benefits versus the costs. The volume of sewage at Kansas City is less than 1% of the minimum Missouri River flow in the area, and this fact combined with detection and removal of nutrients at the Kansas City water treatment facility where the volume of water requiring treatment for nutrient removal is less than 1.0% of the river flow is cited as reason for not removing nutrients at sewage treatment facilities. The quality of water currently in the Missouri River is such that advanced waste treatment for Kansas City would probably have an insignificant effect on the quality of the water in the receiving stream. (Kreager-FIRL) W77-00044

**WASTEWATER SLUDGE AS A FERTILIZER SUBSTITUTE,**  
Ohio State Univ., Columbus. Dept. of Agricultural Economics and Rural Sociology.  
For primary bibliographic entry see Field 5E. W77-00046

**DISCOUNTED CASH FLOW ANALYSIS TO SELECT EQUIPMENT,**  
Entech Corp., Dumont, N. J.  
R. Briller.  
Journal of the Environmental Engineering Division-ASCE, Vol. 102, No. EE3, p 595-611, June, 1976. 6 tab, 2 ref.

Descriptors: \*Cost analysis, \*Waste water treatment, \*Aeration, \*Efficiencies, \*Cost comparisons, Economics, Equipment, Operating costs, Capital costs.

A discounted cash flow analysis method for selecting waste water treatment equipment with the lowest overall cost is presented. Operating and capital costs as well as equipment life and discount rate are used as input for a specific example involving surface aerators in a municipal sewage treatment plant. Realistic values in terms of capital and operating costs, inflation rate, and other variables are also used in the example. The results show that an aerator which costs \$5000 more but uses 4-5 horsepower less and one-fifth as much lubricating oil is \$5723 cheaper than another aerator in terms of the present value of the total overall costs. The most sensitive variable in the example is the efficiency of the aerators. An improvement of 4.2% in the efficiency of the cheaper aerator is sufficient to eliminate the overall cost differential. A general examination of the sensitivity analysis used for the above example reveals that variables which are less critical in the example problem can become more significant for cases where different values of the independent variables are used. (Kreager-FIRL)  
W77-00049

#### WASTES FIND FERTILE FIELD AS LOW-COST PLANT NUTRIENTS

For primary bibliographic entry see Field 5E.  
W77-00050

#### EQUALIZATION OF TIME VARIABLE WASTE LOADS

Marquette Univ., Milwaukee, Wis. Dept. of Civil Engineering.  
V. Novotny, and R. M. Stein.  
Journal of the Environmental Engineering Division-ASCE, p 613-625, June, 1976. 7 fig, 2 tab, 16 ref.

Descriptors: \*Waste water treatment, \*Model studies, \*Mathematical models, \*Flow, \*Unsteady flow, Flow characteristics, Equalizing reservoirs, Hydraulic structures, Hydraulic transients, Hydraulics, Analytical techniques.

A mathematical model describing influent variability removal in waste water treatment systems is presented. Input-output relationships for completely mixed basins, dispersed flow basins, and plug flow basins are developed using time-series analysis and transformation in the frequency domain. The models describe equalization of concentration or waste load fluctuations assuming linear systems with first-order decay. Model-derived design formulas for purely random and harmonic inputs are obtained, assuming completely mixed treatment systems. The model approach is demonstrated and verified by an evaluation of the performance of two dispersion flow equalization basins and completely mixed laboratory units. The evaluation results indicate good agreement between measured and computed equalization characteristics. (Kreager-FIRL)  
W77-00052

#### FLOW APPROACHING FILTER WASHWATER TROUGHS

Camp, Dresser and McKee, Inc., Boston, Mass.  
J. A. French.  
Journal of the Boston Society of Civil Engineers Section American Society of Civil Engineers, Vol. 62, No. 4, p 139-160, January, 1976. 8 fig, 1 tab, 12 ref.

Descriptors: \*Filtration, \*Mathematical models, \*Flow, \*Filters, Hydraulics, \*Design criteria, Separation techniques, \*Waste water treatment, Performance, Evaluation, Suspended solids.  
Identifiers: \*Filter backwashing, Backwashing.

A potential flow model is used to study the flow of backwash water (laden with filtered solids) in its progress from the top of the filter bed to the wash-water troughs above the filter. For a given trough spacing, the round-bottom trough that minimizes

the region of nonuniform flow above a filter bed is one with an external total width equal to 0.25 times the center-to-center spacing and with a total external draft equal to 0.20 times the center-to-center spacing. This design also promotes more efficient flushing of floc particles from the filter. Diminution of the nonuniform flow region and more efficient flushing can also be promoted by decreasing the trough spacing, but there are practical lower limits to trough spacing. Paths and travel times of fluid elements and suspended particles are investigated for the above optimal trough design and two alternative designs. (Kreager-FIRL)  
W77-00053

#### WATER-REUSE SYSTEMS STAR AT CINCINNATI AICHE MEETING

L. J. Ricci.  
Chemical Engineering, Vol. 83, No. 15, p 86, 88, July 19, 1976. 1 fig.

Descriptors: \*Water reuse, \*Reclaimed water, \*Waste water treatment, \*Reclamation, \*Symbiosis, Activated sludge, Reverse osmosis, Filtration, Adsorption, Ion exchange, Sludge, Industrial wastes, Phosphorus, Pilot plants, Organic compounds, Chemical wastes.  
Identifiers: Ultrafiltration.

Laboratory and pilot-scale developments in water reuse systems are reviewed. A new pilot-scale scale system that renovates organic chemical-laden waste water for reuse in manufacturing operations is described that combines activated sludge treatment, physical/chemical treatment, reverse osmosis, and primary and secondary ion exchange. Another pilot unit has demonstrated the effectiveness of ultrafiltration for concentrating dilute latex waste waters for reuse. Laboratory studies have determined that certain natural and synthetic adsorbents are effective for removing leachate contaminants from various industrial sludges. The adsorption materials include fly ash, bottom ash, zeolite, vermiculite, illite, kaolinite, culite, activated carbon, and activated alumina. Other laboratory studies have shown that flue gas desulfurization gypsum sludges hold potential as efficient removers of phosphorus from waste waters. However, undesirable contaminants such as sulfates in the sludge solubilize in the waste water and may cause environmental problems. (Kreager-FIRL)  
W77-00054

#### AWT PLANT BEGINS OPERATIONS

Public Works, Vol. 107, No. 8, p 104, August, 1976.

Descriptors: \*Tertiary treatment, \*Waste water treatment, \*Reclamation, \*Reclaimed water, \*Treatment facilities, Activated sludge, Nitrification, Denitrification, Bacteria, Viruses, Suspended solids, Oxygen demand, Chlorination, Sewage, Storm water, Illinois, Municipal wastes, Cities, Ammonia, Nitrates, Nitrites, Nitrogen.  
Identifiers: \*Chicago(III).

An advanced waste water treatment plant owned by the Metropolitan Sanitary District of Greater Chicago is described. Plant design is based on a biological nitrification-denitrification process. A two-stage activated sludge treatment process is used to convert ammonia to nitrites and nitrates which eventually are released as nitrogen gas after the addition of methanol to assist the biological reaction. The resulting effluent is so low in oxygen demand, suspended solids, and viral and bacterial content that it meets all national pure water policy criteria and allows for downstream recreational uses. The facility will treat 50 million gallons/day of waste water from the Chicago suburbs of Schaumburg and Palatine as well as provide primary treatment and chlorination for approximately 100 million gallons/day of combined storm and sewage overflows before discharge to Salt Creek. (Kreager-FIRL)  
W77-00055

#### ACTIVATED CARBON ODOR CONTROL SYSTEM

Hagerstown Water Pollution Control, Md.  
M. G. McGahey, and R. L. Poltorak.  
Public Works, Vol. 107, No. 7, p 47, July, 1976.

Descriptors: \*Activated carbon, Odor, \*Sludge, \*Sewage treatment, Hydrogen sulfide, Organic compounds, Treatment facilities, Equipment, Costs.

Identifiers: Odor control.

An activated carbon system for removing sewage treatment odors resulting from the conversion of two primary clarifiers to sludge thickeners is described. The thickeners are covered with an 80 by 30 foot gabled roof. Pressure gages are placed on the discharge lines to allow plant operators to adjust the level of air pressure without entering the covered area. A 10 by 10 foot carbon filter building houses fiberglass reinforced grid which is covered with a polypropylene mesh screen to retain 3000 pounds of granulated activated carbon. A 4000 cubic foot/minute blower draws the gases from the thickeners through the 3-foot bed of carbon where hydrogen sulfide and organic compounds are stripped from the air. An adjacent sludge well is also vented through the filter, correcting an additional odor problem. Equipment and component system costs amount to about \$15,000. (Kreager-FIRL)  
W77-00056

#### AUTOMATIC HIGH DENSITY SLUDGE DISCHARGE CONTROL USING ULTRASONICS

Water Services, Vol. 80, No. 964, p 372, June, 1976. 2 fig.

Descriptors: \*Waste water treatment, \*Sludge treatment, \*Automatic control, \*Automation, \*Density, Equipment, \*Ultrasonics, Electrical equipment, Flow.

A high density sludge discharge controller which uses ultrasonics to automatically detect the level and density of raw sludge being transferred to digester or disposal systems and to minimize unwanted transfer of water is described. The sludge density controller which consists of a glass-lined pipe section fitted with two ultrasonic crystal sensors is installed in the sludge outlet line. The control unit may be mounted on the pipe section or located at a remote site. The plant process timer starts the transfer of sludge in accordance with a preset schedule by operating a pump or motorized valve. An external delay timer of several minutes duration overrides the function of the sludge density controller until the pipe is clear of low density sludge from the previous transfer cycle. Thick sludge then passes to the digester until the sludge density controller detects a decrease in percentage of solids being transferred. When the decreased percentage of solids continues to remain at less than the set point for more than 10 seconds, the sludge density controller operates to shut off the pump or valve. A sludge level control may also be incorporated into the system to detect and control the sludge level in settling tanks. (Kreager-FIRL)  
W77-00058

#### WASTEWATER PLANT DESIGN REDUCES OFF-SITE ENERGY NEEDS

Water and Sewage Works, Vol. 123, No. 2, p 41-43, February, 1976. 3 fig.

Descriptors: \*Waste water treatment, \*Treatment facilities, \*Design criteria, \*Energy conversion, Economics, Conservation, Municipal wastes, Sludge treatment, Methane, Sewage treatment.

A waste water treatment plant design that minimizes off-site energy requirement is described. The design is expected to result in a projected savings of \$3594 in heating oil and \$875 in electricity annually by the integrated use of

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5D—Waste Treatment Processes

solar collectors, heat pumps, a small building shell, and basic concrete materials. Methane gas produced by the plant's waste treatment process and an electric generator will provide energy on cloudy days. The process design flow is for 450,000 gallons of sanitary sewage/day. Treatment is to be primary and secondary, including screening, bacteria-nutrient-oxygen-interfacing, settlement, and sludge digestion. The effluents will consist of chlorinated water and dewatered sludge. The plant is designed to service a community of 4200 residents. (Kreager-FIRL)  
W77-00059

#### OXYGEN FOR EFFLUENT TREATMENT.

Water Services, Vol. 80, No. 964, p 379-380, June, 1976. 2 fig.

Descriptors: \*Oxygenation, \*Activated sludge, \*Waste water treatment, \*Bubbles, Equipment, Treatment facilities, Performance, Waste treatment, Liquid wastes, Biological treatment.  
Identifiers: Sludge bulking.

The use of oxygen injection for improving effluent treatment is discussed. Two oxygenation systems currently available are described. In one of these systems, bubbles are generated by introducing oxygen in fine bubble form using a high pressure stream of liquor. When the water and gas enter a sludge tank through expansion nozzles, the already small bubbles are shattered into millions of quickly dissolving micro-bubbles. The other system is a bell-shaped diffuser which achieves highly efficient dissolution by maintaining a suspension of bubbles in a flowing column of liquor contained within an open based bell. The varying velocities of the liquor ensure retention of bubbles of all useful sizes, thus enabling virtually total oxygen dissolution. Both systems are useful for preventing anaerobicity in activated sludge systems and thus avoiding sludge death and subsequent sludge bulking. (Kreager-FIRL)  
W77-00060

#### NEW ACTON GRANGE WORKS.

Effluent and Water Treatment Journal, Vol. 16, No. 5, p 248-250, May, 1976. 1 fig.

Descriptors: \*Sewage treatment, \*Treatment facilities, \*Activated sludge, \*Biological treatment, Aeration, Sludge treatment, Weirs, Retention, Flow control.  
Identifiers: \*United Kingdom.

A new sewage treatment facility in the United Kingdom is described. The new facility is an activated sludge type and is designed to produce a final effluent meeting the Royal Commission Standard. The facility will serve both existing and proposed needs within the parishes of Appleton, Grappenhall and Thelwall, Stockton Heath, Stretton, Halton, and Walton. The preliminary treatment consists of the use of curved bar screens; solids deposited on the screens pass through a disintegrator and return to the flow and then go to detritors that automatically remove any grit. Any flows which are greater than three times that of the normal anticipated dry weather flow pass over an overflow weir into storm water balancing tanks for retention and subsequent treatment. The remaining sewage flows to primary settling tanks, aeration tanks, and final settling tanks before biological treatment. Sludge from the primary tanks is pumped into sludge holding tanks for up to 28 days retention. (Kreager-FIRL)  
W77-00061

#### SAN DIEGO: CIVIL ENGINEERING INNOVATIONS ABOUND.

Civil Engineering-ASCE, Vol 46, No. 2, p 68-73, February, 1976. 1 fig, 1 tab.

Descriptors: \*Sewage treatment, \*Treatment facilities, \*Municipal wastes, \*Pacific Ocean, Ter-

tiary treatment, Water pollution effects, California, Cities, Water reuse, Recycling, Planning, Aquaculture, Heavy metals, Viruses.  
Identifiers: \*San Diego(Calif).

Plans for upgrading municipal sewage treatment in San Diego are discussed. Presently, San Diego's municipal sewage receives only primary treatment, with discharge being to the Pacific Ocean through a 2-mile outfall sewer. Current plans call for sticking with primary treatment but increasing the plant capacity to provide full primary treatment of the higher-than-design flows now being treated. The usefulness of upgrading to secondary treatment is questionable since 12 years of monitoring data indicate that the impact of treatment plant discharges on ocean life is not acute. Eventually, the city plans to upgrade to tertiary treatment and recycle the tertiary effluent. Uncertainties concerning the effect of heavy metals and viruses on people, however, call for a cautious approach in terms of recycling treated water back to the water supply system. Consideration is also being given to the possible practice of aquaculture around sewage outfalls. (Kreager-FIRL)  
W77-00063

#### RECENT ADVANCES IN SLUDGE TREATMENT AND DISPOSAL.

Department of the Environment, Ottawa (Ontario). Wastewater Technology Centre. W. H. Schroeder, and D. B. Cohen. Water and Pollution Control, Vol. 114, No. 7, p 15-21, 24-25, 27, 38-39, July, 1976. 10 fig, 3 tab.

Descriptors: \*Sludge treatment, \*Sludge disposal, \*Reclamation, \*Byproducts, Waste disposal, Biochemical oxygen demand, Suspended solids, Biological treatment, Waste storage, Waste treatment, Dewatering, Drying, Fertilizers, \*Reviews.  
Identifiers: Literature reviews.

Advances in sludge treatment and disposal are reviewed. Topics discussed include: sludge stabilization, conditioning, dewatering, drying, and reduction; the use of treated sludge as a fertilizer and soil improvement agent; land reclamation uses; landfill disposal; energy and resource recovery processes; ocean disposal; and underground storage and disposal of sludge. Anaerobic digestion is receiving renewed interest because of the potential benefits of methane production, new design alternatives based on kinetic models, and the present emphasis on land application of digested sludge. However, anaerobically digested mixtures often produce supernatant recycle which is high in biochemical oxygen demand and suspended solids. A recent advance in anaerobic digestion involves thermophilic operation of the digesters as compared to operation in the mesophilic range. (Kreager-FIRL)  
W77-00064

#### IS NUTRIENT REMOVAL WORTHWHILE,

Iowa State Univ., Ames. Dept. of Animal Ecology. R. W. Bachmann, and J. R. Jones. Water and Wastes Engineering, Vol. 13, No. 2, p 14-16, February, 1976. 2 fig.

Descriptors: \*Waste water treatment, \*Nutrient removal, \*Phosphorus, \*Lakes, \*Evaluation, Mathematical models, Surface water, Water quality control, Eutrophication.

An objective basis for evaluating the potential benefits of removing nutrients from waste water to prevent eutrophication of surface waters is presented. The initial step in the process is to determine whether nutrient removal will exert a significant effect on the receiving bodies of water. A semi-empirical equation for determining the concentration of phosphorus in natural lakes is presented to illustrate that the phosphorus concentration is directly proportional to the annual inputs and inversely proportional to the depth of the lake. The magnitude of the reduction in phosphorus

load to a given body of water from a nutrient removal program ultimately depends on the relative amounts of phosphorus being contributed to the lake from other sources such as surface runoff and rainfall. A study of 34 streams in Iowa is presented to illustrate that in this case few benefits from nutrient removal at waste water facilities are likely to result because of the relatively heavy loadings from nonpoint sources. (Kreager-FIRL)  
W77-00065

#### ECOLOGICALLY BALANCED COMMUNITY WASTEWATER DISPOSAL SYSTEMS MANAGEMENT FOR DEVELOPING COUNTRIES.

Jadavpur Univ., Calcutta (India). N. Chaudhuri, and A. Basu. Journal of the Institution of Engineers (India), Vol. 56, Pt. EN2, p 71-75, February, 1976. 5 fig, 7 tab, 7 ref.

Descriptors: \*Reclamation, \*Reclaimed water, \*Waste water treatment, \*Cities, Programs, Economics, Lagoons, Sludge, Fish farming, Fertilizers, Land use, Symbiosis, Asia.  
Identifiers: \*India.

A water reclamation management program for urban centers in India is proposed. The program involves the use of stabilization lagoons for waste water treatment, the use of primary sludge as fertilizer in surrounding greenbelt areas, and the conversion of algae into fish protein through pisciculture. Cost estimates for both stabilization lagoons and bio-filters are presented for urban communities in India and indicate that the use of lagoons reduces the treatment costs by two-thirds and saves 185 megawatts of power. The proposed reclamation system is land-intensive, requiring 3.24 hectares for primary and secondary lagoons, 1.21 hectares for pisciculture and recreation, and 17.82 hectares for land treatment in order to reclaim 4.54 million liters/day of waste water. (Kreager-FIRL)  
W77-00066

#### POWDERED ACTIVATED CARBON IMPROVES ANAEROBIC DIGESTION.

Norristown Sewage Treatment Plant, Pa. M. Hunsicker, and T. Almeida. Water and Sewage Works, Vol 123, No 7, p 62-63, July, 1976. 1 fig.

Descriptors: \*Activated carbon, \*Sewage treatment, \*Digestion tanks, \*Treatment facilities, Odor, Costs, Performance, On-site tests, Evaluation, Digestion, Sludge, \*Anaerobic digestion.

The use of powdered activated carbon to improve anaerobic digestion at a sewage treatment plant is described. Starting with an initial slug of 1800 pounds of activated carbon to each primary digester, followed by a dose of 350 pounds/day thereafter, improved supernatant quality and increased gas production were observed a month after application. Prior to carbon use, relatively poor supernatant clarity limited the amount of raw sludge that could be added to the digesters to about 33,000 gallons/day. After carbon addition twice this volume was drawn while still returning a cleaner supernatant to the pre-aeration chamber. Plant odors are also reduced. Secondary effluent quality is more uniform than it is prior to carbon addition and is meeting all applicable standards. The cost incurred in purchasing the activated carbon has been far offset by savings resulting from the elimination of deodorant chemicals at the plant. (Kreager-FIRL)  
W77-00067

#### FUNCTIONAL DESIGN OF SANITARY SEWERS.

Pakistan Univ. of Engineering and Technology, Lahore. Inst. of Public Health Engineering and Research. K. M. Yao.



Journal Water Pollution Control Federation, Vol 48, No 7, p 1772-1778, July, 1976. 5 fig, 5 ref.

Descriptors: \*Sewers, \*Design criteria, \*Hydraulics, Chemical reactions, \*Self purification, Hydraulic structure, Sanitary engineering, Engineering structures, Conveyance structures, Roughness coefficient, Hydrogen sulfide.

Criteria for the design of sanitary sewers are reviewed. The functional design of sanitary sewers involves the consideration of three items: hydraulics, self-cleaning action, and biochemical reactions. In current practice, it is assumed that self-cleaning of sanitary sewers is obtained by maintaining a minimum velocity of flow regardless of sewer size. However, a more rational approach may be to use the critical shear stress as the basis for the design of self-cleaning sewers since the basic mechanism of self-cleaning action is the hydrodynamic shear exerted on the sewer boundary by the flowing waste water. The design requirements of the critical shear stress approach for self-cleaning action tend to follow a pattern similar to those for hydrogen sulfide control. In both cases, the required minimum velocity increases with sewer size. For sewers with a Manning's roughness coefficient of 0.013 or less, a design critical shear stress in the range of 0.03-0.04 lb/sq ft will probably keep self-cleaning sanitary sewer systems free of hydrogen sulfide problems. For sewers with a Manning's roughness coefficient of 0.015 or greater, a design critical shear stress of 0.04 lb/sq ft seems preferable to achieve the same effects. These conclusions are valid at least within the size range up to about 60 in. (Kreager-FIRL) W77-00068

**TUNNELING MACHINE USED FOR DRAIN TUNNEL FOR ROUNDHILL SEWAGE TREATMENT WORKS BREAKS RECORD.**  
For primary bibliographic entry see Field 8C. W77-00069

**SEWERING THE CITY OF NEW YORK.**  
New York City Environmental Protection Administration.  
M. Lang, C. Samowitz, M. Jethwani, and F. Novotny.  
Civil Engineering-ASCE, Vol 46, No 1, p 54-57, January, 1976. 2 fig, 1 tab.

Descriptors: \*Sewers, \*Sewerage, \*Hydraulic structures, \*Costs, \*Programs, New York, Conveyance structures, Economics.  
Identifiers: \*New York City.

Efforts to update New York City's sewage collection system are reviewed along with current financial constraints hindering further development. Between the years 1967 and 1972, a crash program to improve the sewer system resulted in increasing the sewer output to \$60 million/year. An accelerated sewer construction program was conceived in 1972, comprising \$1.5 billion over the next 10 years. The key concept of the program was to proceed on entire drainage areas rather than on the piecemeal production of individual laterals to appease complaints on a given block. Recent financial difficulties, however, have at least temporarily stalled the program, with only about \$10 million in funding going for sewer repairs. A breakdown of the city's sewerage needs is tabulated by individual boroughs. (Kreager-FIRL) W77-00070

**MAINE SEWER BID 39% BELOW ESTIMATE.**  
Engineering News-Record, Vol. 197, No. 7, p 45, August 12, 1976.

Descriptors: \*Interceptor sewers, \*Construction, \*Hydraulic structures, \*Pipelines, \*Materials, Conveyance structures, Costs, Maine, Sewage, Municipal wastes.  
Identifiers: \*Portland(Me).

The construction of a proposed interceptor sewer for the city of Portland, Maine is discussed. The new interceptor will replace an existing brick sewer that discharges raw sewage into the Fore River and into Casco Bay. Work on the project includes the installation of about 5500 ft of 48-inch diameter reinforced concrete interceptor pipe along Portland's Commercial Street which runs adjacent to the river and bay. The pipeline will be installed in open trenches. Additionally, a 4500-foot long and 36-inch in diameter prestressed concrete force main will be constructed to carry the sewage from the interceptor to a new treatment plant. Overflow and diversion structures also will be built. About 400 ft of the new pipeline will be encased in concrete in areas where the interceptor will run under a series of railroad crossings. The lowest bidder for construction of the project dropped 39% below the consulting engineer's \$3.9 million estimate. (Kreager-FIRL) W77-00071

**PLANNING AND CONSTRUCTION OF BIRMINGHAM'S MAIN OUTFALL SEWER.**  
Metropolitan Borough of Wolverhampton (England). Dept. of Technical Services.  
M. V. King.  
Chartered Municipal Engineer, Vol. 103, p 87-95, June, 1976. 5 fig, 4 tab, 2 ref.

Descriptors: \*Sewers, \*Waste water treatment, \*Urban drainage, \*Urban hydrology, Hydraulic structures, Conveyance structures, Costs, \*Construction, \*Design criteria.  
Identifiers: \*Birmingham(Gt. Brit).

The design and construction of a main outfall sewer for the city of Birmingham (Great Britain) is described. Design is based on conditions which will prevail after major redevelopment is completed in the area and accommodates a 5-year storm in the foul water system. Design involving the storm water system is for a 2-year interval storm. The setting of overflows is based on frequency of operation, with storm flows being evaluated for frequent storms. The route of the main outfall is designed to collect together as many sewers as possible for routing to the Minworth Sewage Works. The most difficult single problem encountered in the project involved connection to the Minworth carrier. Detailed maps of the city illustrate the location of the main outfall sewer, overflow, the Minworth carrier, and drainage patterns. Cost estimates for the construction of the drainage system are also presented. (Kreager-FIRL) W77-00072

**A RETROSPECTIVE ON THE STRUCTURAL STABILITY OF RCC SPUN SEWER PIPES.**  
National Water Authority of Jamaica (Kingston).  
V. S. Chauhan.  
Journal of the Institution of Engineers (India), Vol. 56, Pt. EN2, p 45-50, February, 1976. 6 fig, 2 tab, 6 ref.

Descriptors: \*Sewers, \*Pipelines, \*Hydraulic structures, \*Conduits, \*Concrete pipes, \*Structural stability, Repairing, Conveyance structures, Sanitary engineering, Materials.  
Identifiers: \*Reinforced cement concrete.

The structural stability of non-pressure cement concrete spun sewer pipes is discussed, with particular emphasis on determining the safe laying depth of such pipes. The supporting strength of a particular pipe classification is shown to be a function of the distribution of the vertical load, bedding conditions, and the lateral pressure which acts on the sides of the pipe. Data on the safe depth of earth cover and over-burden for various bedding conditions are tabulated according to pipe diameters ranging from 150-1800 mm. Methods for detecting and repairing structural deficiencies in spun sewer pipes are also briefly outlined. (Kreager-FIRL) W77-00073

**LARGE-DIAMETER CORRUGATED STEEL PIPE ENTERS STORM SEWER FIELD.**  
Water and Pollution Control, Vol. 114, No. 7, p 14-15, July, 1976.

Descriptors: \*Sewers, \*Steel pipes, \*Storm drains, \*Conduits, \*Materials, Conveyance structures, Hydraulic structures, Pipes, Costs, Construction, Indiana.  
Identifiers: Indianapolis(Ind).

The installation of 11-foot diameter, fully-lined corrugated steel pipe storm sewers via tunnelled construction is described as part of the Indianapolis, Indiana storm relief sewer project. The galvanized steel pipe which consists of 3 by 1 inch corrugations and spiral lockseam construction is first interior sprayed with bituminous material plus additives of asbestos and mica as a tack coating. This assures adherence of the finish coat, a centrifugally-spun liner of asphalt. Finally, asphalt is sprayed onto the pipe exterior for added corrosion resistance. Because of its comparatively light weight, the pipe can be winched into preplanned position. An 18-foot section weighs 7300 pounds as compared to 30,800 pounds for a 6-foot section of concrete pipe. Use of the 11-foot diameter steel pipe instead of 13-foot concrete pipe reduces the overall tunnel size to 13 ft, resulting in a savings of more than \$100,000 in construction costs for a 1200-foot section. (Kreager-FIRL) W77-00074

**SEWER FORCE MAIN HELPS SOLVE POLLUTION PROBLEM.**  
Water and Sewage Works, Vol. 123 No. 7, p 48, July, 1976. 1 fig.

Descriptors: \*Sewers, \*Recreation facilities, \*Conveyance structures, \*Hydraulic structures, Construction Materials, Pipelines, Alabama, Sewerage, Pipes, Concrete.  
Identifiers: Mobile(Ala).

The use of a 48-inch prestressed sewer force main to help solve the pollution problem affecting a heavily used recreational area in Mobile, Alabama is described. The construction of the main is part of a plan to abandon an Eslava Creek treatment plant which discharges into the Dog River and pump to a McDuffie pollution control plant for effluent dispersal into the Mobile River. The force main which extends from a new Eslava Creek pumping station to the McDuffie pollution control plant includes 560 ft of 36-inch prestressed concrete pressure pipe and 26,400 ft of 48-inch prestressed pressure pipe. A blind cross at the McDuffie plant will permit future expansion of the line. A 1900-foot section of the 48-inch pipe was installed above ground on piers because of unstable soil conditions. Another section of the project called for 50 ft of tunneling under the Louisville and Nashville Railroad and 168 ft of tunneling under Interstate 10. (Kreager-FIRL) W77-00075

**KAMINISTQUIA INTERCEPTOR SEWER COMPLETED IN THUNDER BAY.**  
Water and Pollution Control, Vol. 114, No. 7, p 42, July, 1976.

Descriptors: \*Sewers, \*Interceptor sewers, \*Conveyance structures, \*Hydraulic structures, Construction, Costs, \*Canada, Sanitary engineering, Waste water treatment.  
Identifiers: Ontario(Canada), Sanitary sewers, Thunder Bay(Ont).

Progress in a major sanitary trunk sewerage program for Thunder Bay, Ontario is described. A 14,000-foot Kaministiquia interceptor sewer tunnel was recently completed at a cost of \$6.3 million. Mining operations on another part of the project, a 5800-foot Neebing/McIntyre interceptor, have also started and are averaging 450 ft a week. Work has also started on another portion of the in-

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### Group 5D—Waste Treatment Processes

terceptor, a 48 by 65-inch diameter tunnel approximately 9000 ft in length. The total construction cost for the interceptor is \$8.9 million. The construction work follows a detailed report which established the most economical means of bringing all sanitary sewage to a common treatment facility. (Kreager-FIRL)  
W77-00076

**PHYSICAL-CHEMICAL TREATMENT IMPROVES IRAN'S URBAN RUNOFF.**  
Tehran Univ. (Iran). Dept. of Environmental Health.  
P. Samar, M. Sarai, N. Razeghi, G. Jamshidnia, and M. Hakimipour.  
Water and Sewage Works, Vol. 123, No. 8, p 77-79, August, 1976. 4 fig, 2 tab, 8 ref.

Descriptors: \*Urban runoff, \*Waste water treatment, \*Coagulation, \*Adsorption, \*Flocculation, \*Sedimentation, Turbidity, Chemical oxygen demand, Lead, Heavy metals, Suspended solids, Separation techniques, Efficiencies, Performance, Activated carbon.  
Identifiers: \*Iran.

Environmental studies in Iran have revealed that a physical-chemical process consisting of coagulation, flocculation, sedimentation, and carbon adsorption is effective in treating urban land runoff. A system employing coagulation with alum, sedimentation, and adsorption with powdered activated carbon yielded average removal efficiencies of 97, 85, and 100% for turbidity, chemical oxygen demand, and lead, respectively. By comparing removal efficiencies in various stages of the treatment process, it was established that turbidity, chemical oxygen demand, and lead are mostly in the settleable and suspended solid forms. Consequently, coagulation, flocculation, and sedimentation result in high removals for these parameters. The optimum dosage of powdered activated carbon was chosen according to the adsorption efficiency of carbon for dissolved organics and averaged 58 milligrams/liter. (Kreager-FIRL)  
W77-00077

**URBAN STORMWATER DETENTION AND FLOW ATTENUATION.**  
H. G. Poertner.  
Public Works, Vol. 107, No. 8, p 83-85, August, 1976.

Descriptors: \*Urban runoff, \*Storm water, \*Detention reservoirs, \*Cities, \*Flow control, Rain, Design criteria, Recreation facilities, Surface waters.

Methods for achieving stormwater detention and flow attenuation in urban areas are discussed, with particular emphasis on detention ponds on earth surfaces, detention of rainfall on parking lots, and rainfall detention on rooftops. The following criteria for designing detention facilities are discussed: the prevention of excess stormwater buildup in habitable areas, the provision of a positive outlet for discharge of inflows when storage capacity is exceeded, the construction of sufficient slopes for detention areas, the proper location of the deeper portions of storage areas, an evaluation of runoff that is likely to enter the storage site from upstream areas, the provision for uniform regulation of release flow rates, the planning of storage areas for more than one purpose, and the calculation of storage volume requirements. The development of storage ponds into recreational facilities is also discussed. (Kreager-FIRL)  
W77-00078

**AN OVERVIEW: SO YOU WANT TO RECYCLE YOUR WASTEWATER. HOW SHOULD YOU BEGIN. IS IT FEASIBLE.**  
G. R. Mace.  
Industrial Water Engineering, Vol. 14, No. 2, p 24-26, April/May, 1976. 5 tab.

Descriptors: \*Water reuse, \*Waste water treatment, \*Reclamation, \*Industrial water, Cost-benefit analysis, Reclaimed water, Economics, Design criteria, Waste disposal, \*Recycling.

A systematic approach for analyzing the economics of waste water disposal versus reuse is presented. The approach consists of four major steps: a detailed analysis of the effluent, a determination of the effect of recycle water on product quality, a survey of waste treatment operations available, and a total economic analysis. Cost data for a hypothetical problem involving the following three alternatives are presented: purchase and sewer disposal of 100% of the water, recycle of 50% and sewer disposal of 50% of the waste water, and recycle of 90% and river discharge of 10% of the waste water. The figures cited are intended only to demonstrate the results that can be derived from a well planned program of industrial plant design. (Kreager-FIRL)  
W77-00079

**DECREASE OF BACTERIAL CONTENT IN DIFFERENT TYPES OF STABILIZATION PONDS.**  
National Environmental Engineering Research Inst., Nagpur (India).  
N. M. Parhad, and N. U. Rao.  
Indian Journal of Environmental Health, Vol. 18, No. 1, p 33-46, 1976. 8 fig, 2 tab, 11 ref.

Descriptors: \*Biological treatment, \*Stabilization, \*Ponds, \*Bacteria, Coliforms, E. coli, Biochemical oxygen demand, Performance, Efficiencies, \*Waste water treatment, Design criteria.  
Identifiers: Enterococci.

Stabilization ponds at three different locations in Nagpur, India were studied to determine decreases in bacterial content. Samples were collected and analyzed for standard plate count, coliforms, E. coli, Enterococci, and biochemical oxygen demand. The pond showing the highest percentage reductions in both biochemical oxygen demand and indicator bacteria had a greater length of liquid travel and a higher initial organic concentration than the other two ponds. Its interconnecting arrangement which permitted surface overflow from one cell to the next, facilitating the transfer of a much larger algal population to the subsequent cell, also appeared responsible for its greater efficiency. The results of the study indicate that in addition to loading, detention period, and other design criteria such factors as the interconnecting arrangement between cells, the mode of operation, and the length of liquid travel also contribute to the bacterial removal efficiency of stabilization ponds. (Kreager-FIRL)  
W77-00080

**WASTEWATER TREATMENT BY REVERSE OSMOSIS.**  
Hitachi Ltd., Tokyo (Japan). Environmental Protection Systems Div.  
A. Shimozato, S. Takahashi, Y. Koike, K. Ebara, and S. Komori.  
Hitachi Review, Vol. 25, No. 4, p 147-152, 1976. 6 fig, 5 tab, 1 ref.

Descriptors: \*Reverse osmosis, \*Scaling, \*Waste water treatment, \*Water reuse, \*Reclaimed water, Reclamation, Industrial wastes, Symbiosis, Membranes, Automation, Design criteria, Recycling, Cleaning, Evaporation, Electrodialysis.

Experiments dealing with membrane scale prevention during waste water treatment with reverse osmosis are reported. An automatic continuous ball cleaning system was developed which permits membrane cleaning during operation. The ball cleaning method involves passing sponge balls through the system for impact with the membrane and for promoting turbulent flow. Although adequate for the prevention of soft scale, it was found necessary to combine ball cleaning with chemical treatment for the prevention of hard

scale. A combined chemical and ball cleaning system was operated continuously for 1500 hours and demonstrated both effectiveness and reliability. The application of reverse osmosis to closed system waste water treatment is illustrated for the electronics industry. The use of electrodialysis and evaporation in closed system treatment is also discussed. (Kreager-FIRL)  
W77-00081

**POLYMERS PLAY INCREASED ROLE IN WATER CLARIFICATION.**  
Calgon Corp., Pittsburgh, Pa.  
J. J. Morrow.  
Water and Sewage Works, Vol. 123, No. 7, p 78-81, July, 1976. 5 fig, 2 tab.

Descriptors: \*Polymers, \*Separation techniques, \*Waste water treatment, \*Coagulation, \*Filtration, Ions, Municipal wastes, Industrial wastes, Performance, Economics, Suspended solids.  
Identifiers: Synthetic organic polymers.

The use of synthetic organic polymers in operations involving solids/liquid separation is discussed. The applications of synthetic organic polymers range from the treatment of surface waters to the removal of suspended solids from the final clarifiers of municipal and industrial waste treatment plants. These polymers have also become instrumental in the development of new treatment applications such as direct filtration and high energy mixing. The high performance of synthetic organic polymers is attributed to their high molecular weights and the variety of electrically charged groups that can be placed along the polymer chain. Cationic polymers, for example, can be used in place of alum and lime for primary coagulation, with the result being a significant reduction in the volume and cost of treatment chemicals. Direct filtration with polymers is a treatment method being employed by an increasing number of municipal water systems. The polymers are applied as primary coagulants directly to the raw water source; after rapid mixing, the water is filtered without the benefits of flocculation and sedimentation. (Kreager-FIRL)  
W77-00082

**WASTEWATER OZONATION: A PROCESS WHOSE TIME HAS COME.**  
Union Carbide Corp., Tonawanda, N. Y.  
H. M. Rosen.  
Civil Engineering - ASCE, Vol. 46, No. 3, March 1976, p 65-69. 4 fig, 1 tab.

Descriptors: \*Waste water treatment, \*Water quality, \*Ozone, \*Chlorine, \*Effluents, \*Chlorinated organic compounds, Legislation, Toxicity, Phenols, Oxidation.  
Identifiers: Cyanide, Hypochlorides, Once-through oxygen method, Oxygen recycle method, Once-through air method, \*Ozonation.

Since 1903 ozone (O<sub>3</sub>) has been used as a polishing agent and disinfectant for potable water, but only recently has ozone been proposed for use as a cost effective way to achieve waste standards. Recently expanding interest is due to higher degree of treatment required by new pollution control laws, awareness of toxicity of chlorine (Cl<sub>2</sub>), the Cl shortage in 1974, the trend toward reuse of treated waste water, technological advances in O<sub>3</sub> research, understanding of O<sub>3</sub> as a strong disinfectant and oxidant creating no secondary pollution problems, and the installation of oxygen activated sludge secondary treatment systems. O<sub>3</sub> has a short half life, reverting quickly back to oxygen leaving nothing but dissolved oxygen in the treated waste water. Cl<sub>2</sub> is toxic to aquatic life; forms chlorinated organic compounds at ppb concentrations which are not removed by traditional dechlorination practices. These non-biodegradable chlorinated organic compounds accumulate in the environment and in aquatic species. O<sub>3</sub> may be

more cost effective than C1 if there is concern for chlorinated products in effluent, effluent toxicity, or if the use of hypochlorites is required for safety. Side benefits of O3 use include increased virus removal, reduced effluent color and/or turbidity, odor and taste control, and effective removal of phenols and cyanides. There are 3 major O3 disinfectant processes. First, the once-through oxygen method where dry oxygen is fed to the O3 generator, the waste water disinfected and off-gas used to feed an oxygen activated sludge process after destruction of unreacted O3. Second, the oxygen recycle method where off-gas is cleaned and dried and returned to the O3 generator. Thirdly, the once-through air method used when an oxygen activated sludge system is not in operation. (Gentry-North Carolina) W77-00099

**THE ELIMINATION OF PHOSPHATES AND NITRATES FROM WASTE WATER BY ALGAL CULTURES: II. TERTIARY TREATMENT POTENTIAL OF ALGAE, (IN DUTCH),** Ghent Rijksuniversiteit (Belgium). Laboratorium voor Anorganische Technische Chemie, Elektrochemie en Elektrochemie. F. M. Bosch, H. Lootens, and E. Van Vaerenbergh. *Natuurwet Tijdschr.* 56(1-4), p 3-16, 1974.

Descriptors: Phosphates, Nitrates, \*Algae, Nutrients, Cultures, \*Tertiary treatment, Farm wastes, \*Waste water treatment, Dairy industry, \*Scenedesmus, \*Chlamydomonas.

Two algal species (*Scenedesmus* and *Chlamydomonas*) were tested in order to evaluate the possibility of tertiary treatment of secondarily treated dairy waste water. The tertiary treatment potential was defined experimentally and using mathematical calculations. (See also W76-01312 and W77-00111)—Copyright 1975, Biological Abstracts, Inc. W77-00110

**THE ELIMINATION OF PHOSPHATES AND NITRATES FROM WASTE WATER BY ALGAL CULTURES. III. (IN DUTCH),** Ghent Rijksuniversiteit (Belgium). Laboratorium voor Anorganische Technische Chemie, Elektrochemie en Elektrochemie. F. M. Bosch, H. Lootens, and E. Van Vaerenbergh. *Natuurwet Tijdschr.* 56(1-4), p 17-26, 1974.

Descriptors: \*Phosphates, \*Nitrates, Algae, Nutrients, Cultures, \*Tertiary treatment, Farm wastes, \*Waste water treatment, Filtration, Activated sludge, Microorganisms, Effluents, Dairy industry.

Tertiary treatment of dairy waste water was performed in 2 discontinuous algal cultures. The treatment efficiency of activated sludge microorganisms was compared with that obtained using a pure algal culture fed with effluent containing similar nutrient concentrations. The effect on tertiary treatment of an intermediate filtration was also investigated. (See also W76-01312 and W77-00110)—Copyright 1975, Biological Abstracts, Inc. W77-00111

**THE USE OF STOCHASTIC MODELS IN THE INTERPRETATION OF HISTORICAL DATA FROM SEWAGE TREATMENT PLANTS,** Wisconsin Univ., Madison. P. M. Berthouex, W. G. Hunter, L. Pallesen, and C. Y. Shih. *Water Research*, Vol. 10, No. 8, p 689-698, 1976. 6 fig, 5 tab, 3 ref.

Descriptors: \*Sewage treatment, \*Treatment facilities, \*Methodology, \*Time series analysis, Regression analysis, Efficiencies, Effluents, Biochemical oxygen demand, Mathematical

models, Systems analysis, Stochastic processes, Suspended solids, Data collection, \*Water pollution control. Identifiers: Autoregressive models, Historical data.

Careful collection and examination of field data are essential if the dynamic performance of sewage treatment plants is to be understood. A 3-year historical record of sewage treatment plant performance has been evaluated graphically and with time series methodology. Models relating influent biochemical oxygen demand to effluent biochemical oxygen demand, mixed liquor suspended solids, temperature, an hydraulic detention time were constructed. Four possible definitions of plant efficiency were defined and studied as well. The use of efficiency rather than effluent BOD for modeling performance was not helpful. A logarithmic transformation of BOD seems to be a better metric than BOD itself. Studying historical records should lead to an improved understanding of plant dynamics. Time series methods seem to be one useful tool for this work. (Bell-Cornell) W77-00121

**EVALUATION OF PROPOSED MAN-MADE PONDS FOR FOOD PRODUCTION TO RECOVER VALUES IN WASTE HEAT AND SOLID ORGANIC SLUDGES,** Massachusetts Univ., Amherst. Water Resources Research Center. J. W. Zahradnik, L. S. Turner, H. G. Levine, and C. Tucker.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-258 773, Price codes: A04 in paper copy, A01 in microfiche. WRRR Publication No. 65, Completion Report FY-76-12, March 1976. 58 p, 14 fig, 3 tab, 22 ref, 4 append. OWRT A-079-MASS(1).

Descriptors: Aquaculture, Organic wastes, Feasibility studies, Effluents, Economic feasibility, Risks, Thermal pollution, \*Nutrient requirements, \*Sewage sludge, Public health, Ponds, \*Waste water treatment. Identifiers: \*Thermal waste, Waste heat, Wastes recovery.

An analysis was conducted to determine: (1) the potential value of using, simultaneously, thermal effluents and sewage sludges in aquatic cultures; (2) the technical and economic feasibility of utilizing multilevel aquatic cultures in the recovery of these wastes; and (3) data voids and uncertainties which are of importance in implementation of the system designed. System inputs, potential system outputs and potential subsystem characteristics were characterized and documented through a literature survey. The alternative solutions were generated and evaluated on the basis of a matrix. Within the systems examined there appears a greater potential to utilize sludge than thermal discharges since a small fraction of the thermal effluents could be accommodated. Economic feasibility was not established. The data voids and uncertainties include the following: (1) kinetics of nutrient availability from sludge in aqueous media; (2) reliability of the subsystems in terms of disease control and invasion of undesirable species; (3) reconciliation of drastically different residence times between nutrient laden waters and thermally useful waters as they flow through subsystems; (4) evaluation of the consumable materials from public health and nuisance perspectives; and (5) effects of the subsystem on groundwater. W77-00150

**EVALUATION OF ACTIVATED SLUDGE CONTROL TECHNIQUES THROUGH PILOT PLANT AND COMPUTER ANALYSES,** Purdue Univ., Lafayette, Ind. Water Resources Research Center. R. E. Roper, Jr., and C. P. Leslie Grady, Jr.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-258 774, Price codes: A10 in paper copy, A01 in microfiche. Technical Report No. 77, June 1976. 192 p, 71 fig, 45 tab, 63 ref, 5 append. OWRT A-033-IND(1).

Descriptors: \*Activated sludge, Biodegradation, Organic loading, Pilot plants, Control, \*Waste water treatment, \*Oxidation, Treatment facilities, Sludge treatment. Identifiers: \*Cell residence time, \*Hydraulic control formula, Sludge age, Bio-oxidation, Sludge thickening.

An approach to activated sludge systems control was developed and experimentally verified in which the key parameter is the sludge age or mean cell residence time. Central to this approach is the use of a hydraulic control formula which can be applied to a wide variety of control situations and can be made plant specific by a simple calibration technique. To supplement the control formula a system descriptive operational diagram was developed which superimposes the predictions from current models for activated sludge bio-oxidation, sludge thickening and oxygen transfer. The diagram allows the operator to visualize the system constraints so that the need for a control action is obvious. The efficacy of the hydraulic control formula was evaluated through the use of two 850 gal/day activated sludge pilot plants. Analysis of the batch settling data indicated good promise for use in describing the sludge thickening constraints imposed on the system by the final settler. W77-00157

**TERTIARY TREATMENT AND REUSE OF ANIMAL WASTES,** Delaware Univ., Newark. Dept. of Agricultural Engineering. W. F. Ritter.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-258 768, Price codes: A03 in paper copy, A01 in microfiche. Completion Report (1976). 36 p, 1 fig, 17 tab, 20 ref. OWRT A-030-DEL(1), 14-31-0001-5008.

Descriptors: \*Farm wastes, Nitrogen, Phosphorus, Chemical oxygen demand, Denitrification, \*Tertiary treatment, \*Waste water treatment, Water reuse, Recycling, Waste disposal.

Two barrier landscape water renovation systems (BLWRS) were operated for nearly two years. The first BLWRS (BLWRS-1) was constructed from a silt loam soil and the second (BLWRS-2) was constructed from a sandy loam soil. Liquid dairy waste was applied to BLWRS-1 at a loading rate of 0.84 cm/day and to BLWRS-2 at loading rates of 0.84-2.45 cm/day. The high loading rate of 2.45 cm/day was only maintained for 47 days because of ponding on the BLWRS surface. The average COD removal rate was 95% for BLWRS-1 and 98% for BLWRS-2, while the nitrogen removal for BLWRS-1 and BLWRS-2 was 87 and 91%, respectively. Both BLWRS removed over 99% of the phosphorus. The treatment efficiency did not change with loading rate or there was no significant change in effluent quality during the different seasons of the year. Besides removing COD, nitrogen, and phosphorus, the BLWRS will remove significant amounts of potassium, sodium, aluminum and zinc from liquid dairy manure. The results also indicate that a BLWRS cannot be operated for the entire winter in the Mid Atlantic States. The estimated annual cost for a waste handling system for a 100 free-stall dairy herd using recycled effluent in a flushing system with a lagoon and BLWRS would be \$7717. The waste handling system using a BLWRS was estimated to be more expensive than four other systems. The BLWRS might have more potential as a tertiary treatment method for motels and campgrounds than for a dairy farm. The greatest potential for using a BLWRS in the livestock industry would probably be with milking center wastes.



## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5D—Waste Treatment Processes

W77-00158

**BIOLOGICAL PURIFICATION OF THE IZMAIL BOARD MILL EFFLUENTS (BIOLOGICHESKAYA OCHISTKA STOCHNYKH VOD IZMAIL'SKOGO TSELYULOZNO-KARTONNOGO KOMBINATA),** E. Kh. Gerts.

Biokhimičeskaya Ochistka Stochnykh Vod, Materialy Respublikanskoi Konferentsii, Vol. 1, p 18-19, 1972, Published 1976.

Descriptors: \*Pulp wastes, \*Waste water treatment, \*Biological treatment, Wastes, \*Industrial wastes, Waste treatment, Water pollution sources, Pulp and paper industry, Biochemical oxygen demand, Hydrogen ion concentration, Municipal wastes, Canneries, Suspended solids, Foreign countries, Water pollution treatment, Treatment facilities.

Identifiers: Kraft mills, \*USSR.

The overall effluent from the Izmail mill which manufactures kraft pulp has a COD (permanganate) of 271.6-354.2 mg/liter or (dichromate) 939-1280 mg/liter, a 5-day BOD of 177.8-226.6 mg/liter, and a pH of 7.2-10.5. Biochemical purification equipment of 20,000 cu m/day capacity, installed in 1965, reduced the COD by 33-61% and the BOD by 63-78.8%. In 1968 the capacity of the equipment was increased to 41,100 cu m/day, and the joint purification of the mill effluents, municipal sewage, and effluents from a canning plant was introduced. Because of the composition of the municipal and canning wastes, the effectiveness of purification was increased to 57.4-62.6% for COD and to 92.6-93.0% for BOD. There was also a nearly 94% reduction of suspended solids. (Stapinski-IPC) W77-00322

**DIMINUTION OF SUSPENDED SOLIDS IN PULP AND PAPER INDUSTRY EFFLUENTS BY TREATMENT WITH CHEMICAL COAGULANTS (DIMINUAREA CONTINUTULUI DE SUSPENSII TOTALE IN APELE REZIDUALE DIN INDUSTRIA CELULOZEI SI HIRTIEI, PRIN TRATAREA CU AGENTI CHIMICI COAGULANTI),** E. Strugariu.

Celuloza si Hirtie, Vol. 25, No. 1, p 27-34, January/March, 1976, 10 fig, 3 tab, 10 ref.

Descriptors: \*Pulp wastes, \*Suspended solids, \*Waste water treatment, \*Coagulation, Wastes, \*Industrial wastes, Waste treatment, Water pollution sources, Water pollution treatment, Water pollution control, Lime, Silica, Bentonite, Clays, Flocculation, Water purification, Chemical precipitation.

Identifiers: Aluminum sulfate, Sodium aluminate, Iron sulfate, Sodium silicate, Carboxymethylcellulose, Polyamine-polyamide-epichlorohydrin condensates, Polyacrylamide.

After a review of the mechanism of action of coagulants, laboratory experiments are reported on the removal of suspended solids from kraft pulp and paper mill effluents by treatment with several coagulants (with or without addition of flocculating aids). Chemicals added to the waste water included aluminum sulfate, lime, sodium aluminate, ferrous sulfate, activated silica, sodium silicate, sodium carboxymethylcellulose, polyamine-polyamide-epichlorohydrin condensate, hydrolyzed polyacrylamide, and bentonite. Only four of these gave good results, namely, sodium aluminate, lime, aluminum sulfate, and activated silica. In optimum doses of 700, 400, 200, and 30 mg/liter, respectively, they achieved a suspended solids reduction to less than 100 mg/liter. Adding lime or bentonite as flocculant aids did not stimulate the coagulating effect of aluminum sulfate. (Brown-IPC) W77-00323

**HYDROLYSIS OF PRESS WASTE WATERS FROM THE MANUFACTURE OF FIBER (INSULATION) BOARDS (CONTRIBUTII LA STUDIUL PROCESULUI DE HIDROLIZA A APELOR DE PRESA DIN CIRCUITUL DE FABRICATIE AL P.F.I.),** R. Butnaru, M. Sirbu, and S. Petrovan.

Celuloza si Hirtie, Vol. 25, No. 1, p 11-17, January/March, 1976, 14 fig, 3 tab, 3 ref.

Descriptors: \*Waste water treatment, \*Hydrolysis, \*Carbohydrates, Wastes, Waste treatment, Water pollution sources, Water pollution treatment, \*Wood wastes, Temperature, Hydrogen ion concentration, Acidity, Corrosion, Chemical degradation, Water pollution control, Waste dilution.

Identifiers: \*Insulation boards, Wood particle boards, Sugars, Wood, Defibration.

Waste waters from the defibration of wood (or wood wastes) and the platen pressing of wood-fiber or wood-particle boards contain about 20-30 g/liter of carbohydrates. The effects of hydrolysis parameters on sugar yield were investigated. Reaction time and temperature were found to have a more pronounced effect than did pH and dilution ratio. Maximum sugar yield was obtained after about 2 hr (118 min), minimum yield at 115°C; above this temperature, the yield increased. The greatest yield increase was observed between pH 0.5 and 1.0, but since this acidity poses corrosion problems, it is recommended to conduct commercial hydrolyses at pH 1.5-1.75. (Brown-IPC) W77-00324

**CHEMICAL-TECHNOLOGICAL CONTROL OF (EFFLUENT) PURIFICATION EQUIPMENT (KHIMIKO-TEKHOLOGICHESKII KONTROL' NA OCHISTNYKH SOORUZHENIYAKH),** Ivdelskii Gidroliznyi Zavod (USSR).

B. N. Egorov, and I. V. Zakharenko. Gidroliznaya i Lesokhimičeskaya Promyshlennost, No. 3, p 20-22, 1976.

Descriptors: \*Fermentation, \*Hydrolysis, \*Waste water treatment, \*Treatment facilities, Operation and maintenance, Foreign countries, Wastes, Industrial wastes, Waste treatment, Water pollution sources, Biochemical oxygen demand, Hydrogen ion concentration, Neutralization, Lime, Suspended solids, Sedimentation, Aeration, Temperature, Phosphorus compounds, Nitrogen compounds, Water pollution treatment, Sands, Oxidation, Wood wastes.

Identifiers: USSR.

The 5-day BOD of wood-hydrolysis and fermentation plant effluents is 1200-1500 mg/liter, depending on their dilution, and their pH is 5-5.5. The effluents are purified by neutralization with lime, separation of sand and other heavy particles, removal of suspended solids by sedimentation, and biochemical oxidation in aeration tanks. In this article, a description is given of the purification equipment at the Ivdel' fermentation plant (U.S.S.R.) and the control of its operation, which consists in daily determinations of 5-day BOD, permanganate oxidizability, suspended solids, and reducing substances, and additional determinations, each month, of temperature and nitrogen and phosphorus contents of the effluents. Because of its insufficient capacity, the equipment will be modernized to achieve a 5-day BOD after purification of 19 mg/liter. (Stapinski-IPC) W77-00327

**BIODEGRADABILITY OF PHENOLIC COMPOUNDS (BIODEGRADABILITA DI COMPOSTI FENOLICI),** P. Maggio, L. D. Angiuro, and B. Focher. Industria della Carta, Vol. 14, No. 3, p 105-111, March, 1976, 7 fig, 2 tab, 24 ref.

Descriptors: \*Phenols, \*Pulp wastes, \*Biodegradation, \*Microorganisms, Wastes, Water pollution sources, Microbial degradation, Water pollution treatment, Water pollution control, Industrial wastes, Aromatic compounds, Organic compounds.

The influence of inoculum types on the biodegradability of phenolic compounds such as occur in pulp mill effluents was evaluated. It was found that the most rapid rate of biodegradation was obtained with an inoculum specially selected for the phenol involved. (Speckhard-IPC) W77-00328

**WASTE WATER TREATMENT AT SCP (SEMICHEMICAL PULP), CGP (CHEMIGROUNDWOOD PULP) MILLS, Daishowa Paper Mfg. Co., Ltd., Fuji (Japan).** I. Ogiya.

Japan Pulp and Paper, Vol. 13, No. 4, p 45-52, December, 1975, 8 fig, 11 tab.

Descriptors: \*Pulp wastes, \*Waste water treatment, Foreign countries, Wastes, Industrial wastes, Waste treatment, Water pollution sources, Water pollution treatment, Oxidation, \*Chemical oxygen demand, Water pollution control, Coagulation, Sedimentation, Activated sludge.

Identifiers: \*Japan, Chemical recovery, Aluminum sulfate, \*Semichemical pulp mills, Chemigroundwood mills.

Effluent treatment at semichemical pulp mills is discussed with emphasis on COD reduction. The following chemical recovery processes used at Japanese semichemical pulp mills are briefly described, including the ESI direct oxidation method (developed jointly by Ebara Manufacturing Co. Ltd. and Saga Paperboard Co.), the SCABillerud process (developed by Svenska Cellulosa AB. jointly with Billerud AB. of Sweden), Tampella process (Tampella AB./Oy. of Finland) and the RAS (recovery process by air oxidation of sodium sulfide) process developed by Mitsubishi Heavy Industries Ltd. of Japan. Flow diagrams are given for each process, and the important chemical reactions in each are discussed. Treatment of the waste water after chemical recovery to further reduce COD is discussed. Experimental data show that coagulation-sedimentation with alum reduces the COD by 36-38%, while activated sludge treatment reduces COD by about 30%. With electrolytic coagulation, COD reduction is approximately 60%. Electrolytic coagulation followed by activated sludge treatment reduced COD by 80%. (Witt-IPC) W77-00329

**BLEACHABILITY OF SOFTWOOD AND HARDWOOD KRAFT PULPS IN OZONE BLEACHING (IN JAPANESE),** Government Industrial Research Inst., Takamatsu (Japan).

H. Kamishima, T. Fujii, and I. Akamatsu. Japan Tappi, Vol. 30, No. 7, p 381-391, July, 1976, 13 fig, 6 tab, 12 ref.

Descriptors: \*Bleaching wastes, \*Ozone, \*Waste water treatment, Wastes, Industrial wastes, Waste treatment, Water pollution sources, Water pollution treatment, Chemical oxygen demand, Biochemical oxygen demand, Activated sludge, \*Pulp wastes, Pine trees, Deciduous trees, Coniferous trees, Chlorine, Effluents.

Identifiers: Beech trees (Fagus), Kraft mills.

Pine and beech kraft pulps of comparable unbleached brightness were treated with ozone. The ozone bleaching waste waters (from pulps above 72% brightness) contained a COD(Mn) pollution load of 30-50 g/kg of pulp; the BOD/COD(Mn) ratio was 0.6-0.8, with higher values for beech than pine-derived effluent. Activated sludge treatment of the ozone bleaching wastes achieved a higher COD reduction than for spent alkaline ex-

traction wastes from chlorine bleach plants; the COD reduction was greater for beech- than for pine-derived effluents. (Brown-IPC)  
W77-00330

#### STATUS REPORT ON ABATEMENT OF EFFLUENTS FROM THE CANADIAN PULP AND PAPER INDUSTRY -- 1974.

Environmental Protection Service, Ottawa (Ontario).  
For primary bibliographic entry see Field 5G.  
W77-00331

#### COLOR REMOVAL FROM SOFTWOOD KRAFT CAUSTIC EXTRACT EFFLUENT BY POLYAMINES.

Institute of Paper Chemistry, Appleton, Wis. T. C. Kisla.  
Ph.D. Thesis, 1976, 110 p. 28 fig, 48 ref, 20 tab.

Descriptors: \*Bleaching wastes, \*Color, \*Waste water treatment, \*Chemical precipitation, Wastes, Industrial wastes, Waste treatment, Water pollution sources, Water pollution treatment, Effluents, Softwood, Water pollution control, Pulp wastes, Pulp and paper industry.

Identifiers: \*Polyamines, \*Amines, Polyethylenimine, Ethylenediamine, 1,12-Diaminododecane, Kraft mills, Diethylenetetramine, Triethylenetetramine.

Polyamines were evaluated for their ability to remove color from the alkaline extraction effluent of a kraft mill bleach plant, and from a reconstituted acid-insoluble fraction of the effluent. Polyethylenimine 18 (having a molecular weight of 1800) removed 85-90% of the color from the effluent in the pH range 7-8.5. Linear polyamines (e.g., di- and triethylenetetramine, ethylenediamine) were less effective for color removal, but they were most effective in acidic conditions. Ethylenediamine and 1,12-diaminododecane removed some color from the effluent, but the other diamines tested did not. A general mechanism of color removal by polyamines is proposed. (Buchanan-IPC)  
W77-00335

#### SORPTION ON ACTIVATED CARBON OF IMPURITIES OF TEXTILE INDUSTRY EFFLUENTS (SORPCJA ZANIECZYSZCZEN ZESKIEKOW PRZEMYSŁU WŁOKNIENICZEGO NA WĘGLU AKTYWNYM).

Centralne Laboratorium Dziewiarstwa (Poland). J. Rouba.

Przegląd Włókienniczy Vol. 30, No. 4, p 217-220, April, 1976. 3 fig, 4 tab, 5 ref.

Descriptors: \*Textiles, \*Waste water treatment, \*Activated carbon, \*Sorption, Wastes, Industrial wastes, Waste treatment, Water pollution treatment, Water pollution control, Odor, Hydrogen ion concentration, Color, Turbidity, Foaming, Chlorides, Sulfates, Iron, Manganese, Organic compounds, Oil, Lipids, Water purification, Economics, Water pollution sources, Cotton, Fabrics, Filters, Sands, Coagulation, Oxidation, Recycling, Water reuse.

Identifiers: Synthetic fabrics, Regenerated cellulose.

Effluents from the production of cotton and cotton-synthetic and regenerated fiber fabrics purified by coagulation, and effluents from the production of regenerated cellulose and synthetic fiber fabrics purified on sand filters, were subjected to additional purification by sorption on granulated activated carbon in a three-column reactor. The effectiveness of the purification was evaluated by determinations of odor, pH, color, turbidity, oxidizability, foam formation, and the contents of chlorides, sulfates, iron, manganese, and organic substances (fats and oils). The results indicate that this method of additional purification is not only effective in removing impurities but

also presents the possibility of achieving a closed cycle of process water. The flexibility of the sorption process makes it possible to control the degree of purification desired. However, this method is economically justified only when applied to effluents that have been purified chemically or biologically or to effluents with a low concentration of impurities, such as wash waters. (Stapinski-IPC)  
W77-00339

#### PAPER CHEMICAL RECLAMATION AND REUSE VIA REVERSE OSMOSIS.

B. Brown, B. Crouse, D. Etter, and W. Schattner.

Research Disclosure, No. 142, p 46, February, 1976. 1 fig.

Descriptors: \*Reverse osmosis, \*Waste water treatment, \*Water reuse, Wastes, Industrial wastes, Water pollution treatment, Waste treatment, Water pollution control, Separation techniques, Membrane processes, Fibers(Plant), Filtration, Water conservation, Industrial water, \*Patents, Recycling.

Identifiers: \*White water(Paper machines).

A reverse osmosis system is described for concentrating white water from a paper machine, the white water having been previously freed of its fiber content through treatment in a filter or decanter. The reverse osmosis unit separates the fiber-free white water into a concentrate of pulp additives (e.g., wet- and dry-strength agents) and a permeate (a form of deionized water). Both the concentrate and the permeate can be recycled in the papermaking process, making it possible to operate the mill on a closed-water system basis. (Speckhard-IPC)  
W77-00340

#### SECONDARY DEGRADATION OF SULFITE MILL WASTE WATER BY DEVELOPMENT OF ALGAL MASSES (SEKUNDAERABBAU VON SULFITZELLSTOFFABWASSER DURCH ALGEN-MASSSENTWICKLUNGEN).

G. Otto.  
Zellstoff und Papier, Vol. 25, No. 6, p 170-173, June, 1976. 3 fig, 1 tab, 8 ref.

Descriptors: \*Pulp wastes, \*Sulfite liquors, \*Algae, \*Waste water treatment, \*Lignins, \*Degradation(Decomposition), Oxidation, Color, Wastes, Industrial wastes, Water pollution sources, Waste treatment, Water pollution treatment, Effluents, Aquatic algae, Biodegradation.

Identifiers: Lignosulfonic acids.

The oxidation processes during the secondary degradation of biochemically pretreated sulfite pulp mill effluents are considerably accelerated in the presence of unicellular green algae. Color elimination of about 98% occurs in 100 days. This effect is attributed primarily to the oxidation of lignosulfonic acids by nascent oxygen arising from algal photosynthetic activity. (Ward-IPC)  
W77-00341

#### PROCESS FOR PURIFYING INDUSTRIAL WASTE WATERS (PROCEDE D'EPURATION D'EAUX USEES INDUSTRIELLES).

CIBA-GEIGY Ltd., Basel (Switzerland).  
French Patent No. 2,189,327. January 25, 1974, 18 p, 7 tab.

Descriptors: \*Waste water treatment, \*Industrial wastes, \*Pulp wastes, \*Textiles, \*Dyes, \*Patents, \*Flocculation, Wastes, Water pollution sources, Waste treatment, Water purification, Anions, Ureas, Water pollution treatment, Water pollution control, Color, Flocculation, Chemical precipitation.

Identifiers: \*Leather, Formaldehyde, Optical brighteners, Dicyandiamide.

A process for decoloring waste waters coming from the textile, paper, or leather industries or from the manufacture of water-soluble anionic dyes or optical (fluorescent) brighteners is characterized by the addition of a water-soluble condensation product of formaldehyde (e.g., with dicyandiamide or urea) and elimination of the resulting flocculated material. (Speckhard-IPC)  
W77-00342

#### PROCESS FOR TREATING WASTE WATER (VERFAHREN ZUR BEHANDLUNG VON ABWASSER).

SCA Development A.B. (Sweden).  
A. H. Karlsson.  
German Patent (Offenlegungsschrift) No. 2,521,893. November 20, 1975. 8 p, 1 tab.

Descriptors: \*Bleaching wastes, \*Waste water treatment, \*Oxidation, \*Patents, Pulp wastes, Neutralization, Organic compounds, Metals, Iron, Iron compounds, Wastes, Industrial wastes, Water pollution sources, Water pollution treatment, Waste treatment, Oxidation-reduction potential.

Identifiers: Hydrogen peroxide, Iron sulfate.

An oxidation process for partially or completely neutralizing organic materials in the effluent from a pulp mill (especially bleaching effluent) involves at least partial oxidation of the materials with hydrogen peroxide in the presence of a metal which can occur in at least two oxidation stages (e.g., iron), the metal being added in its lowest oxidation state (e.g., as ferrous sulfate). (Speckhard-IPC)  
W77-00343

#### SANITARY-BACTERIOLOGICAL EVALUATION OF THE METHOD OF TREATMENT AT A SMALL SEWAGE PLANT, (IN RUSSIAN), B. G. Vodop'Yan, Y. P. Zhil'Tsov, S. P. Shchennikov, and T. F. Kuznetsova.

Gig Sanit 4, p 95-97, 1975.

Descriptors: \*Sewage treatment, \*Waste water treatment, \*Aeration, \*Oxidation lagoons, Settling basins, Filters, Filtration, Chlorination, Pathogenic bacteria, Activated sludge, Microorganisms.

Identifiers: Salmonella-typhimurium, Sand filters, Sand filtration.

Sewage treated in aeration tanks and settling basins required additional treatment in sand filters, filter beds and biological oxidation ponds. Sand filtration and subsequent chlorination eliminates the entry of pathogenic microorganisms (e.g., Salmonella typhimurium) into a water body. Treatment of excess activated sludge in aerobic stabilizers is highly effective in a bacteriological respect and is recommended for wide use.—Copyright 1976, Biological Abstracts, Inc.  
W77-00350

#### EFFECTIVENESS OF WASTEWATER TREATMENT AT THE SHOSTKA 50TH ANNIVERSARY OF THE USSR CHEMICAL PLANT, (IN RUSSIAN).

A. A. Ipatova, S. S. Badyva, N. Y. Biryukova, and V. M. Nefedchenkov.  
Gig Sanit 4, p 101-102.

Descriptors: \*Waste water treatment, \*Chemical wastes, Industrial wastes, Recycling, Reuse, Aeration, Oxidation lagoons.

Identifiers: \*Shostka River, \*USSR, \*Photography chemical wastes.

The sanitary characteristics of the Shostka River before and after treatment of the wastewaters of the Shostka photographic chemical plant are described. A water-recycling system returns more than 90% of the water for reuse. Aeration tanks have improved the sanitary condition of the river

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5D—Waste Treatment Processes

below the effluent outlet.—Copyright 1976, Biological Abstracts, Inc.  
W77-00351

**NEW METHOD OF SEWAGE SLUDGE DECONTAMINATION, (IN RUSSIAN),** All-Union Scientific Research Inst. of Medical Parasitology and Tropical Diseases, Moscow (USSR).  
V. Y. Kebina, R. Y. Agranonik, and N. A. Romanenko.  
Gig Sanit 4, p 102-103, 1975.

Descriptors: Sewage sludge, \*Sewage treatment, \*Sludge treatment, \*Waste water treatment, Soils, \*Centrifugation, Dewatering, Heat treatment, Fertilizers, Separation techniques.

Sewage sludge is preliminarily centrifuged at a dilution factor of more than 1000; the centrifugate is put into the soil by a hydraulic borer and the dehydrated sludge is heat-treated and used as fertilizer.—Copyright 1976, Biological Abstracts, Inc.  
W77-00352

**BASF COMPLETES TEN-YEAR PROJECT FOR CLEANING UP THE RHINE,** Water Services, Vol. 79, No. 958, p. 507-508, 1975.

Descriptors: \*Sewage treatment, \*Industrial wastes, \*Domestic wastes, Treatment facilities, Separated sewers, Interceptor sewers, Cost repayment, Landfills, Landscaping, Sludge treatment, Europe, Pollution abatement.  
Identifiers: \*Combined waste treatment, Badische Anilin- und Soda-Fabrik, \*Rhine River (Germany), Ludwigshafen (Germany), Frankenthal (Germany).

Badische Anilin- und Soda-Fabrik at Ludwigshafen, Germany, has completed a waste treatment plant covering 86 acres. The facility also treats the sewage of the cities of Ludwigshafen and Frankenthal. The investment represents 200 million deutsche marks, with operating costs of DM 70 million annually. The effluent from BASF and Ludwigshafen totals approximately 185 mgd and is collected in an interceptor sewer where it is neutralized. After removal of coarse solids, the waste water is pumped through pressure mains; the Frankenthal sewage is then added and filtered; then directed to primary sedimentation tanks, then to aeration basins. BOD is reduced 95%, COD and TOD are reduced 75%; 70-100 ppm nitrates are removed by the biological system. The concentrated sludge is treated with ash recycled from the sludge incineration process. The waste gases from sludge incineration are cleaned in electrostatic precipitators. Ludwigshafen pays for the cost of its sewage treatment based on the BOD load. The final, clarified effluent (restricted to 20/30 ppm BOD, 20/40 ppm SS, and a temperature not to exceed 30°C) is released to the Rhine River. Solid wastes are landfilled on a 198-acre island site by a process developed by BASF. The various treatment procedures are described. (Auen-Wisconsin).  
W77-00403

**EFFECT OF SPRINKLING PASTURES WITH POTATO STARCH FACTORY WASTE EFFLUENTS ON QUALITY OF RAW MILK, AND DEVELOPMENT OF A PROCESS FOR REMOVAL OF PROTEIN, AMINO ACIDS AND POTASSIUM FROM WASTES. (IN JAPANESE)** Obihiro Zootechnical Univ. (Japan). Lab. of Chemical Technology Milk Products.  
K. Sukegawa, H. Ariga, S. K. Takahashi, K. Matsumura, and S. Tanabe.  
Res Bull Obihiro Univ Ser I. 9(2), p 273-286, 1975.

Descriptors: \*Effluents, Wastes, Water pollution sources, \*Industrial wastes, Waste water disposal, \*Milk, Potatoes, Nitrogen, Potassium, E. coli, \*Bacteria, Magnesium, Phosphorus, Salmonella, \*Disinfection, Waste water treatment.

Identifiers: Amino-Acids, \*Cows, Escherichia-Coli, Staphylococcus, Starch, \*Bacteria removal processes.

Milk from cows which ate pasture sprinkled with waste effluents from a potato starch factor was studied. The best method for removing N compounds and K from the wastes was determined. Wastes containing high ratios of various elements were decanted. Concentrations of N, K and P were about 2000, 2800 and 300 ppm, respectively. The bacteria in the wastes were mostly common bacteria (105-108/ml) and Escherichia coli groups (10-106/ml). Salmonella and Staphylococcus were also present. Most of these bacteria came from the soil. The growth and yield of grass sprinkled with wastes were very good, although unusual amounts of nitrate, K and P accumulated in the grass. No statistically significant differences were recognizable in milk composition from cows which grazed either the experimental or control pastures. In the sprinkled pasture the P content in the milk was slightly higher than normal and the Mg content in the milk slightly lower, although these values were not abnormal. Only slight traces of nitrate and nitrite were detectable in the milk from both pastures. Of the N compounds in the decanted wastes, 40-45% were removed by heat (70°C); 25% of the waste N content could be decreased by this method. About 80% of non-protein N and 95% of the K were removed from the decanted wastes by ion-exchange.—Copyright 1976, Biological Abstracts, Inc.  
W77-00420

**THE COST OF PHYSICAL CHEMICAL TREATMENT (PCT) WASTE WATER,** Commonwealth Scientific and Industrial Research Organization, Melbourne (Australia). Div. of Chemical Technology.  
S. Y. Ip.  
Water (Journal of the Australian Water and Waste-water Association) Vol. 3, No. 1, p 11-13, March 1976. 1 tab, 1 fig, 9 ref.

Descriptors: \*Waste water treatment, \*Treatment facilities, \*Operating costs, \*Australia, \*Cost comparisons, Recycling, Phosphorus, Filtration, Chlorination, Dewatering.  
Identifiers: \*Physical chemical treatment, Clarification, Recalcination, Recarbonation, Ammonia stripping.

A series of estimated Australian costs is presented stage by stage for plants with operating capacities of 0.1, 1.0 and 10 mgd, in order to allow comparison of costs between recycling treated industrial effluent and the purchase and disposal of water via sewers. Processes included are: Phosphorus removal with or without recalcination, lime mud dewatering and recalcination, ammonia stripping, recarbonation and clarification, filtration, chlorination, and an activated carbon column. (CSIRO)  
W77-00445

**GS/MS (GAS CHROMATOGRAPHIC/MASS SPECTROMETRIC) ANALYSES OF ORGANIC COMPOUNDS IN TREATED KRAFT PAPER MILL WASTEWATERS,** Environmental Protection Agency, Athens, Ga. Southeast Environmental Research Lab.  
For primary bibliographic entry see Field 5A.  
W77-00456

**CENTRIFUGE PLUS LIME LIMITS LIGNIN IN WASTE WATER,** R. Moll.  
Southern Pulp and Paper Manufacturer, Vol. 39, No. 6, p 14-15, June, 1976. 1 fig, 3 illus, 1 tab.

Descriptors: \*Pulp wastes, \*Lignins, \*Lime, \*Chemical precipitation, \*Waste water treatment, \*Centrifugation, Wastes, Industrial wastes, Waste treatment, Color, Sludge treatment, Burning,

Water purification, Costs, Pulp and paper industry, Water pollution sources, Water pollution treatment, Water pollution control, Treatment facilities, \*Louisiana.  
Identifiers: Clarifiers, Centrifuges.

Lignin is removed from the effluent of Continental Can Company's kraft mill at Hodge, Louisiana, by adding lime and allowing the color bodies to precipitate with the fiber fines in a clarifier. The sludge is removed and centrifuged in a model P-5400 Super-D-Canter centrifuge. Dry cake extracted by the centrifuge is delivered to the lime kiln for burning, together with the caustic mud extracted by vacuum filters. The solids content of the centrifuge cake varies from 30 to 40%. The centrifuge removes 83.3% of the solids coming in. The cost of the entire waste treatment system, which includes all direct costs, as well as engineering time and supervision costs, was \$2,300,000. The system treats 9,000,000 gallons of effluent/day, equivalent to a paper production rate of 750 tons/day. (Witt-IPC)  
W77-00464

**SPENT SEMICHEMICAL PULPING LIQUORS. (V). IMPROVEMENT OF COLOR-REMOVAL EFFICIENCY BY PHOTOCHEMICAL TREATMENT (IN JAPANESE),** Kyushu Univ., Fukuoka (Japan).  
S. Meguro, K. Sameshima, M. Sumimoto, and T. Kondo.  
Japan Tappi, Vol. 30, No. 8, p 444-449, August, 1976. 6 fig, 1 tab, 8 ref.

Descriptors: \*Sulfite liquors, \*Pulp wastes, \*Color, \*Waste water treatment, \*Ultra-violet radiation, Wastes, Industrial wastes, Waste treatment, Water pollution sources, Radiation, Water pollution control, Water pollution treatment, Organic compounds, Oxygenation, Hydrogen ion concentration, Temperature, Chemical oxygen demand, Aeration, Pollution abatement, Irradiation. Identifiers: Rose bengal, Periodates, Acetyl acetone, Hydrogen peroxide, Photochemistry, \*Photochemical treatment.

Earlier work proved that various kinds of spent pulping liquors could be decolorized by fairly long irradiation with high-pressure UV lamps. Further studies concentrated on shortening the irradiation of spent neutral sulfite semichemical liquor containing 250 ppm of organic matter which had thus far defied effective decolorization. Among influential factors examined (oxygenation, air bubbling, pH, temperature), oxygen bubbling was the most effective. It accelerated the photo-induced decoloring rate in both alkaline and acid media. The effect increased at elevated temperature. The best decoloration (90%) and a 40% COD decrease were achieved at pH 12 and 60°C upon irradiation plus oxygen bubbling for about 2 hr. Several chemical additives were tried during room-temperature irradiation for 1.5 hr (alkaline) or 2.5 hr (acidic). The best result (about 90% color removal) was obtained with 25 ppm of rose bengal and periodate at pH 12 or 5, or with acetyl acetone and hydrogen peroxide at pH 5. Lower amounts of rose bengal sufficed at pH 5 to attain significant decoloring effects. (Brown-IPC)  
W77-00465

**EFFLUENT-FREE BLEACHED KRAFT PULP MILL. PART VII. SODIUM CHLORIDE IN ALKALINE PULPING AND CHEMICAL RECOVERY,** Erco Envirotech Ltd., Islington (Ontario).  
For primary bibliographic entry see Field 3E.  
W77-00466

**WATER QUALITY ASPECTS OF WELL RECHARGE WITH RECLAIMED WATER, BAY PARK, NEW YORK,** Geological Survey, Albany, N.Y.  
J. Vecchioli.



In: Biological Control of Water Pollution; Proceedings of the International Conference on Biological Water Quality Alternatives, March 3-5, 1975, University of Pennsylvania, Philadelphia, Pennsylvania; American Society of Civil Engineers, p 295-299, 1976. 1 fig, 1 tab, 4 ref.

Descriptors: \*Water reuse, \*Injection wells, \*Artificial recharge, \*Water quality, \*New York, Aquifers, Reclaimed water, Water treatment, Sewage treatment, Tertiary treatment, Chemical reactions, Water chemistry, Chemical analysis, Waste water treatment.  
Identifiers: Bay Park(NY), \*Long Island(NY), Magoghy aquifer(NY).

From 1968 to 1973, water reclaimed from sewage was used in a series of deep-well artificial-recharge experiments at Bay Park, N. Y., by the U. S. Geological Survey in cooperation with the Nassau County Department of Public Works. This paper summarizes water-quality aspects of the recharge tests. Microbial growth around the well screen caused significant well clogging when unchlorinated water was injected. The higher filter efficiency of the fine to medium sand of the aquifer restricted movement of bacteria away from the point of injection. In tests in which chlorinated water was recharged, clogging by microbial growth was insignificant. However, whenever there was an appreciable pause between the end of injection and the start of repumping, the first water repumped had a strong sulfide odor, was highly turbid, and was laden with bacteria. Chemical quality of the reclaimed water was modified by interaction with the aquifer. Iron concentration of the mixed native and reclaimed waters increased to as much as 3 milligrams per liter from background levels of a few tenths in each; pH decreased to a low of about 4.5 from levels of about 5.5 for native water and 6.1 for reclaimed water. Residual phosphorus was removed almost completely, but nitrogen uptake by the aquifer was minimal. (Woodard-USGS) W77-00492

## 5E. Ultimate Disposal Of Wastes

**ENVIRONMENTAL IMPACT OF CADMIUM AND OTHER HEAVY METALS FROM LAND-APPLIED SEWAGE SLUDGE,** Wisconsin Univ., Madison. Dept. of Soil Science. For primary bibliographic entry see Field 5C. W77-00002

**PROCEEDINGS OF THE 1975 NATIONAL CONFERENCE ON MUNICIPAL SLUDGE MANAGEMENT AND DISPOSAL.** Environmental Protection Agency, Washington, D.C. Office of Research and Development. For primary bibliographic entry see Field 5D. W77-00009

**REGIONAL WASTEWATER SOLIDS MANAGEMENT PROGRAM LOS ANGELES-ORANGE COUNTY METROPOLITAN AREA,** Los Angeles-Orange County Sludge Program, Whittier, Calif. D. Burack. In: Proceedings of the 1975 National Conference on Municipal Sludge Management and Disposal, August 18-20, 1975, Anaheim, California, p 26-29. 4 fig.

Descriptors: \*Sludge disposal, \*Sludge treatment, \*Recycling, \*Programs, \*Governmental interrelations, Waste disposal, Reclamation, Incineration, Dewatering, Byproducts, Solid wastes, Municipal wastes, California, Industrial wastes, Transportation, California.  
Identifiers: Pyrolysis, Los Angeles(Calif), Orange County(Calif).

A regional waste water sludge management program for the Los Angeles-Orange County metropolitan area is described. The program is to be conducted under a Joint Powers Agreement by the three major waste water agencies in the region with the assistance of the State of California and the United States Environmental Protection Agency. The following disposal or recycling alternatives will be studied: recycling of waste water solids for agricultural uses, soil reclamation, and use as soil supplement; disposal of waste water solids to land; waste water solids disposal to the ocean; incineration and pyrolysis processes for volume reduction and resource recovery; and conditioning, dewatering, and composting. In conjunction with these alternatives, transportation and sludge processing as well as the disposal of industrial sludges will also be studied. (See also W77-00009) (Kreager-FIRL) W77-00011

**URBAN SLUDGE DISPOSAL OR UTILIZATION ALTERNATIVES, SOCIO-ECONOMIC FACTORS,** Environmental Protection Agency, Philadelphia, Pa. Region III. A. Montague.

In: Proceedings of the 1975 National Conference on Municipal Sludge Management and Disposal, August 18-20, 1975, Anaheim, California, p 60-64. 4 tab.

Descriptors: \*Sludge disposal, \*Social aspects, Economics, \*Municipal wastes, \*Reclamation, Sludge treatment, Waste water treatment, Attitudes, Symbiosis.

Socio-economic factors affecting the implementation of various urban sludge disposal and utilization alternatives are discussed, with particular emphasis on land spreading. Although resistance in rural areas by neighboring communities to accept land spreading as a means of sludge utilization has been minimal, the same climate of receptiveness and cooperation has not yet developed in many large metropolitan areas. One source of concern hindering the use of municipal sludge for land spreading purposes is the heavy metal content of sludges. However, once psychological attitudes toward the utilization of waste materials become more favorable, the implementation of prudent management practices in sludge utilization should control the degree of environmental stress. The development of an active public awareness program on the benefits and liabilities of proposed sludge processing systems is recommended along with a realistic program for controlling heavy metals in waste water collection systems. Comparative costs of various sludge disposal and utilization techniques are presented to illustrate the economic advantages of landspreading sludge in specific situations. (See also W77-00009) (Kreager-FIRL) W77-00013

**SLUDGE MANAGEMENT ALTERNATIVES FOR COASTAL CITIES,** Engineering-Science, Inc., Berkeley, Calif. T. Bursztynsky, and J. Davis. In: Proceedings of the 1975 National Conference on Municipal Sludge Management and Disposal, August 18-20, 1975, Anaheim, California, p 65-72. 13 tab, 7 ref.

Descriptors: \*Sludge disposal, \*Municipal wastes, \*Cost-benefit analysis, \*Reclamation, \*Social aspects, Economics, Waste disposal, Oceans, Feasibility studies, California.  
Identifiers: Ocean disposal.

Findings from a study of seven alternative sludge disposal options for the Southern California coastal area are summarized. Ocean disposal appears to be the least cost option by a wide margin, and its total abandonment is considered a misallocation of resources unless the environmental im-

pact is clearly demonstrated to be greater than that of more costly alternatives. Composting for sale appears to be the most desirable method of sludge management on an overall basis. Environmental risks are minimized and some benefits are realized. The system has good public acceptability, land use compatibility, ease of implementation, and financial feasibility. To a large extent this is the system being employed at Los Angeles and Orange Counties, indicating that natural selection processes of public pressure, economic considerations, and environmental awareness have been at work. Detailed breakdowns of environmental, feasibility, performance, and economic factors are presented for the various sludge management alternatives considered. (See also W77-00009) (Kreager-FIRL) W77-00014

**BY-PRODUCT SOLIDS MANAGEMENT ALTERNATIVES CONSIDERED FOR PHILADELPHIA,**

Greeley and Hansen, Chicago, Ill. E. F. Ballotti, and T. E. Wilson. In: Proceedings of the 1975 National Conference on Municipal Sludge Management and Disposal, August 18-20, 1975, Anaheim, California, p 73-79. 7 tab, 1 ref.

Descriptors: \*Municipal wastes, \*Solid wastes, \*Waste water treatment, \*Waste disposal, \*Reclamation, Economics, Biological treatment, Byproducts, Fertilizers, Pennsylvania.  
Identifiers: \*Philadelphia(Penn).

Alternative methods of managing byproduct solids generated by waste water treatment plants in the Philadelphia area are discussed. Biological processes generally rank better than physical-chemical processes from a cost, energy, and nutrient utilization standpoint. A number of land disposal alternatives utilizing anaerobically digested solids appear to have potential as acceptable management programs; however, it does not appear that a land disposal alternative is feasible for the total amount of solids removed in Philadelphia. The sea dispersal alternative, also utilizing anaerobic digestion as the stabilization process, has proven to be simple, economical, and easily controlled. Preliminary feasibility studies on an anhydrous and liquid ammonia alternative appear promising. This alternative utilizes anaerobic digestion and converts excess digestion gas to the form of fertilizer commonly used for crop fertilization in the United States. (See also W77-00009) (Kreager-FIRL) W77-00015

**SLUDGE DISPOSAL ALTERNATIVES FOR BOSTON,** Havens and Emerson Ltd., Cleveland, Ohio. G. D. Simpson.

In: Proceedings of the 1975 National Conference on Municipal Sludge Management and Disposal, August 18-20, 1975, Anaheim, California p 80-85. 1 fig, 5 tab, 5 ref.

Descriptors: \*Sludge disposal, \*Municipal wastes, \*Incineration, \*Cost-benefit analysis, \*Dewatering, Reclamation, Byproducts, Programs, Waste water treatment, Massachusetts, Waste disposal, Land use, Feasibility studies.

Findings from a study of sludge disposal alternatives for the city of Boston are presented. Among three final alternatives considered (land application, dewatering and incineration, and wet oxidation), dewatering and incineration is the least cost option, being lower in capital cost than the nearest alternative by about \$7.6 million and lower in total annual cost by about \$1.6 million/year. From environmental and other non-cost standpoints, incineration rates are equal to or better than the other two alternatives in seven of nine categories; whereas land application rates are equal to or better than the other alternatives in only three of

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5E—Ultimate Disposal Of Wastes

nine categories. Based on the above findings, a detailed project plan is for chemically conditioning, vacuum filtering, and incinerating sludge from Boston's waste water treatment plants. Incinerator ash will be utilized for landfill to provide additional space required for a future secondary treatment plant. Ash leachate will be collected and recycled to treatment. (See also W77-00009) (Kreager-FIRL)  
W77-00016

**ALTERNATIVES FOR DISPOSAL FOR THE METROPOLITAN DENVER SEWAGE DISPOSAL DISTRICT NO. 1.**  
Metropolitan Denver Sewage Disposal District Number 1, Commerce City, Colo.  
W. J. Martin, and J. D. Boyle.  
In: Proceedings of the 1975 National Conference on Municipal Sludge Management and Disposal, August 18-20, 1975, Anaheim, California p 86-90.

Descriptors: \*Sludge disposal, \*Municipal wastes, \*Reclamation, \*Feasibility studies, \*Economics, Cities, Colorado, Recycling, Symbiosis, Fertilizers, Waste water treatment, Byproducts.  
Identifiers: \*Denver(Colo).

Findings from a study of alternative methods for disposing of or utilizing sludge generated by waste water treatment facilities in the Metropolitan Denver area are presented. Agricultural reuse is considered the most desirable sludge management system for the district based on environmental, engineering, and economic considerations. The system requires little power compared to other alternatives, and methane gas which is a byproduct of anaerobic digestion can be used to heat and mix the digesters. Outside fuel power will be required only to operate various pumps in the system and vehicles at the drying and distribution center. The reuse system is also attractive because of its relatively simple operation and inherent flexibility for final sludge use. Additionally, the fertilizer or soil conditioner produced from sludge is a valuable agricultural resource in view of current and projected fertilizer shortages. Research efforts being conducted by the Metropolitan Denver Sewage Disposal District on the environmental impact of sludge utilization are also outlined. (See also W77-00009) (Kreager-FIRL)  
W77-00017

**UPDATING THE 1974 PITTSBURGH CONFERENCE.**  
Environmental Protection Agency, Washington, D. C.  
For primary bibliographic entry see Field 5D.  
W77-00019

**SUMMARY OF THE ASCE SEMINAR ON SLUDGE DISPOSAL.**  
MCA Engineering Corp., Baltimore, Md.  
For primary bibliographic entry see Field 5D.  
W77-00020

**THE PAST, PRESENT, AND FUTURE PROSPECTS OF BURNING MUNICIPAL SEWAGE SLUDGE ALONG WITH MIXED MUNICIPAL REFUSE.**  
Weston (Roy F.) Inc., West Chester, Pa.  
E. M. Smith, and A. R. Daly.  
In: Proceedings of the 1975 National Conference on Municipal Sludge Management and Disposal, August 18-20, 1975, Anaheim, California, p 115-123. 4 fig, 1 tab, 35 ref.

Descriptors: \*Sludge disposal, \*Incineration, \*Municipal wastes, \*Sewage sludge, Treatment facilities, Dewatering, Drying.  
Identifiers: Co-incineration, Mixed municipal refuse.

The use of co-incineration for burning municipal sewage sludge along with mixed municipal refuse

is discussed in terms of past experience and future prospects. Experience with burning sludge in conventional refractory-wall mixed municipal refuse incinerators indicates that the moisture present in the sewage sludge depresses furnace temperature, thus necessitating reductions in excess air to hold the furnace gas temperature within the desirable range of 1400-1800F. However, when thickened sludge feed is used, adequate furnace temperatures can not be maintained even with zero excess air. Thus, it is necessary to dewater the sludge to about 20% solids, followed by drying, before the sludge solids are fed to the incinerator. A co-incineration option for the future is the use of conventional sludge incinerators modified to handle shredded and cleansed mixed municipal refuse. Various experimental co-incineration installations presently in operation throughout the world are described. (See also W77-00009) (Kreager-FIRL)  
W77-00021

**MANAGEMENT OF MUNICIPAL WASTE-WATER TREATMENT RESIDUALS.**  
National Science Foundation, Washington, D. C.  
For primary bibliographic entry see Field 5D.  
W77-00023

**PYROLYSIS OF SEWAGE SLUDGE.**  
Environmental Protection Agency, Cincinnati, Ohio.  
R. A. Oleksy.  
In: Proceedings of the 1975 National Conference on Municipal Sludge Management and Disposal, August 18-20, 1975, Anaheim, California, p 139-145. 4 fig, 6 tab, 13 ref.

Descriptors: \*Sludge disposal, \*Sewage sludge, \*Organic compounds, \*Distillation, Incineration, Waste disposal, Pilot plants, Feasibility studies, Moisture content.  
Identifiers: \*Pyrolysis, Refuse.

The feasibility of using pyrolysis for sewage sludge disposal is discussed along with some preliminary findings from pilot-scale tests conducted by the Environmental Protection Agency and the Bureau of Mines. Pyrolysis is the destructive distillation of organic materials under heat and/or pressure in the absence of oxygen. Tests involving the pyrolysis of sludge alone reveal that the process represents a substantial improvement over conventional incineration with respect to fuel consumption and air pollutant emissions. However, the high moisture content of sewage sludge favors the use of a combination of sludge and dry organic material to reduce the energy requirements associated with evaporating the moisture in the sludge. Tests with mixtures of sludge and shredded solid waste indicate that this approach is feasible, although both the environmental aspects and economics of the process require further investigation. (See also W77-00009) (Kreager-FIRL)  
W77-00024

**SLUDGE PYROLYSIS FOR ENERGY RECOVERY AND POLLUTION CONTROL.**  
Stanford Research Inst., Menlo Park, Calif.  
F. M. Lewis.  
In: Proceedings of the 1975 National Conference on Municipal Sludge Management and Disposal, August 18-20, 1975, Anaheim, California, p 146-152. 6 fig, 1 tab, 9 ref.

Descriptors: \*Sludge disposal, \*Distillation, \*Waste treatment, \*Energy conversion, \*Thermodynamics, Treatment facilities, Heavy metals, Incineration, Economics.  
Identifiers: \*Pyrolysis.

The use of pyrolysis for sludge decomposition is discussed. Pyrolysis is an irreversible chemical change brought about by the action of heat in an atmosphere devoid of oxygen and offers advantages over conventional incineration in terms of fuel economy, energy recovery (steam genera-

tion), and control of heavy metals. An analysis of the thermodynamics of various pyrolysis systems reveals that a proprietary pyrolysis reactor that is indirectly heated by the afterburner flue products requires the least amount of auxiliary fuel. For maximum efficiency in pyrolysis systems, a high solids content in the sludge cake and a low excess air rate are desirable. Techniques are currently available for producing a sludge cake in excess of 40% total solids. The steam generated by a pyrolysis system treating sludge can be used for the generation of electricity or for operation of aerators and pumps at waste water treatment plants. (See also W77-00009) (Kreager-FIRL)  
W77-00025

**A SLUDGE POLICY FOR THE 70'S.**  
Environmental Protection Agency, San Francisco, Calif. Region IX.  
L. R. Freeman.  
In: Proceedings of the 1975 National Conference on Municipal Sludge Management and Disposal, August 18-20, 1975, Anaheim, California, p 153-155.

Descriptors: \*Sludge disposal, \*Municipal wastes, \*Legal aspects, \*Institutions, Programs, Waste disposal, Conservation, Recycling, Reclamation.

Municipal sludge disposal is discussed in terms of the responsibilities of the Environmental Protection Agency for setting a policy consistent with recent environmental legislation. Since Federal law and Federal/state policies require that feasible alternatives to ocean disposal must be pursued, the first step in formulating a sludge disposal technique should involve the reclamation or recycling of it in light of current conservation needs. Emphasis is placed on implementing existing technology to deal with existing or impending sludge disposal problems. The importance of effective institutional arrangements and public participation in the implementation of sludge disposal policies is discussed. (See also W77-00009) (Kreager-FIRL)  
W77-00026

**ECOLOGICAL IMPACT OF THE DISPOSAL OF MUNICIPAL SLUDGE ONTO LAND.**  
McCormick (Jack) and Associates, Inc., Devon, Pa.  
J. Schmid, D. Pennington, and J. McCormick.  
In: Proceedings of the 1975 National Conference on Municipal Sludge Management and Disposal, August 18-20, 1975, Anaheim, California, p 156-168. 9 fig, 2 tab, 16 ref.

Descriptors: \*Sludge disposal, \*Municipal wastes, \*Ecology, \*Land use, Agriculture, Waste disposal, Legislation, Reclamation, Recycling, Symbiosis.

An evaluation of the ecological impact of disposing of municipal sludge on land is presented against the background of current water pollution legislation. A review of major land uses and characteristics in the United States and the potential impact of land disposal on natural vegetation and wildlife indicates that sludge disposal on land can be environmentally acceptable. Sludge application, as contrasted to land-filling, is most appropriate. The most attractive sites for sludge disposal appear to be those that are presently utilized for crop and livestock production. The multiple use of these lands should be considered a national priority so that waste water can be reused to improve soil conditions and fertility. Approximately 18% of the total land surface in the conterminous states is considered to be unsuitable for land disposal. (See also W77-00009) (Kreager-FIRL)  
W77-00027

**PLANT UPTAKE OF HEAVY METALS FROM SEWAGE SLUDGE APPLIED TO LAND.**  
Department of Agriculture, Beltsville, Md.

For primary bibliographic entry see Field 5D.  
W77-00028

**EFFECTS OF SEWAGE SLUDGE OR EFFLUENT APPLICATION TO SOIL ON THE MOVEMENT OF NITROGEN, PHOSPHORUS, SOLUBLE SALTS AND TRACE ELEMENTS TO GROUNDWATERS,**  
California Univ., Riverside. Dept. of Soil Science and Agricultural Engineering.  
For primary bibliographic entry see Field 5C.  
W77-00029

**ENGINEERING STUDY AND FIELD DEMONSTRATION TRIALS FOR SAND DUNE STABILIZATION,**  
Ward (George D.) and Associates, Portland, Oreg. G. D. Ward.  
In: Proceedings of the 1975 National Conference on Municipal Sludge Management and Disposal, August 18-20, 1975, Anaheim, California, p 200-203. 1 tab.

Descriptors: \*Dunes, \*On-site tests, \*Soil stabilization, \*Organic wastes, \*Wind erosion, Erosion control, Soil erosion, Oregon.

Organic wastes were used in soil stabilization studies in a severe wind erosion area in northeast Oregon. The first study involved soil building using fibrous wastes. Numerous solid wastes in various concentrations were incorporated into a sandblow, which was then planted with dryland grasses in late 1972 and evaluated in 1973. The second study applied on a larger scale the sand control procedures which were found effective during the first study. Physical stabilization and seeding procedures were undertaken during the fall of 1973 and early spring of 1974. The program is similar to programs in Israel, the Isle of Jersey in the English Channel, and the Lowry Bombing Range in Colorado. In Israel, shredded municipal waste is covered with a layer of sand, then reseeded with desert vegetation. On Jersey, composted and shredded municipal waste, blended with blow sand, is used for developing turf. In Colorado, Denver's total sewage sludge is used to build soil. A layer of the sludge, which is mechanically thickened, is deposited, plowed, disced, and then seeded. The result is healthy range grass which is productive and resistant to wind erosion. Organic wastes successfully used in Oregon include liquid sewage sludge, papermill sludge, shredded bark and woodwastes, and feedlot bedding. A nitrogen source such as sewage sludge or feedlot waste must be provided with papermill sludge. (See also W77-00009) (Snyder-FIRL)  
W77-00032

**POTENTIAL HEALTH IMPACTS OF SLUDGE DISPOSAL ON THE LAND,**  
Environmental Protection Agency, Research Triangle Park, N.C.  
For primary bibliographic entry see Field 5C.  
W77-00033

**FDA'S OVERVIEW OF THE POTENTIAL HEALTH HAZARDS ASSOCIATED WITH THE LAND APPLICATION OF MUNICIPAL WASTE-WATER SLUDGES,**  
Food and Drug Administration, Washington, D.C. G. L. Braude, C. F. Jelinek, and P. Corneliusen.  
In: Proceedings of the 1975 National Conference on Municipal Sludge Management and Disposal, August 18-20, 1975, Anaheim, California, p 214-217. 3 tab.

Descriptors: Pollutant identification, \*Public health, \*Hazards, \*Land use, \*Sludge, Municipal wastes, Waste water (Pollution), Federal government.  
Identifiers: Food and Drug Administration.

While proper use of good sludge on crops would not normally be expected to present a problem, contamination when sludges are improperly processed or applied on the wrong crops is of concern to the Food and Drug Administration (FDA). Direct physical contact with crops is a possible contamination mechanism. Contaminants may be retained in tissues of animals exposed when grazing or eating forage. Complete definitions of safe practices are currently unavailable due to insufficient data on the transfer of many contaminants through the food chain and on the toxicological effects to be expected. Many metals, including cadmium, are found at higher levels in crops grown on sludged soil than in controls in the same area. Sewage sludge contains persistent organic contaminants. Studies have shown that edible parts of plants contain these organics at levels 5 to 20% of the levels in the soils. The most likely contamination of foods would be in animals coming in contact with sludge and following failures of the sewage plant operation. The microbiologists feel crops eaten raw should not be planted within 3 yr of the last sludge application. Related FDA activities include surveys for heavy metals and pesticides in agricultural products, development of analytical methodology for heavy metals and pesticides, investigations on the survival of pathogens on vegetables grown in sludge treated soil, and toxicological studies to determine the effects of heavy metals and interaction between elements. There is currently no indication that sludge use must be limited to crops not in the human food chain or that all sludges are suitable for land application. (See also W77-00009) (Snyder-FIRL)  
W77-00034

**PROCESSING, ECONOMICS AND SALE OF HEAT DRIED SLUDGE,**  
Environmental Protection Agency, Cincinnati, Ohio.  
For primary bibliographic entry see Field 5D.  
W77-00037

**COMPOSTING RAW SLUDGE,**  
Agricultural Research Service, Beltsville, Md.  
For primary bibliographic entry see Field 5D.  
W77-00038

**CHEMICAL CHANGES IN THE SOIL SOLUTION FROM A SPODOSOL IRRIGATED WITH SECONDARY-TREATED SEWAGE EFFLUENT,**  
Florida Agricultural Experiment Station, Gainesville. Soil Science Dept. C. C. Hortenstine.  
Journal of Environmental Quality, Vol. 5, No. 3, p 325-338, July-September, 1976. 6 fig, 1 tab, 10 ref.

Descriptors: \*Irrigation effects, \*Waste water disposal, \*Soil analysis, \*Chemical analysis, Nitrogen, Phosphorus, Potassium, Nitrates, Nitrification, On-site investigations.  
Identifiers: Spodosols.

Chemical changes in spodosols from near Orlando, Florida were investigated after irrigation with secondary-treated sewage effluent. Irrigation at a rate of 5 cm/week was initiated in July 1972 in an attempt to determine the renovative capability of the Spodosols. Phosphorus content increased from 0.03 ppm at all soil depths in the fall/winter of 1971/1972 to 1.25 ppm at 60 cm, 1.00 ppm at 90 cm, and 0.85 ppm at 120 cm by the fall of 1974. During this same period, potassium increased from 0.05 ppm at all three depths to 14 ppm. Nitrate-nitrogen, however, was consistently below 1.0 ppm. The effluent contained an average of 2.2 ppm nitrate-nitrogen, 14 ppm Kjeldahl nitrogen, 2.8 ppm phosphorus, and 16 ppm potassium. Laboratory tests of the soil indicated satisfactory nitrification; however, adverse conditions in the field curtailed the nitrifying process. Proper water control by tile installations will likely provide conditions that are suitable for nitrification. (Kreager-FIRL)  
W77-00040

**BIOASSAY PROCEDURES FOR THE OCEAN DISPOSAL PERMIT PROGRAM,**  
Environmental Protection Agency, Gulf Breeze, Fla. Environmental Research Lab.  
For primary bibliographic entry see Field 5A.  
W77-00041

**WASTEWATER SLUDGE AS A FERTILIZER SUBSTITUTE,**  
Ohio State Univ., Columbus. Dept. of Agricultural Economics and Rural Sociology. D. L. Forster, T. J. Logan, R. H. Miller, and R. K. White.  
Public Works, Vol. 107, No. 8, p 79-80, August, 1976. 2 tab, 3 ref.

Descriptors: \*Sewage sludge, \*Fertilizers, \*Sludge disposal, \*Farms, Costs, Irrigation, Overland flow, Ohio, Surveys, Viruses, Heavy metals, Monitoring, Attitudes.  
Identifiers: Land spreading.

Data from a survey of waste water sludge land spreading practices in 43 communities throughout the state of Ohio are presented. The survey showed that all but nine of the communities using sludge as fertilizer were employing some type of sludge analysis at least semi-annually. About a third of the communities were also checking water quality near disposal sites. The equipment used for applying the sludge to land consisted mostly of tank trucks with either gravity or pumped discharge. Only four of the communities employed irrigation-overland flow systems. Average sludge handling costs per dry ton ranged from \$25.20 for a plant flow capacity of 20 million gallons/day to \$69.70 for a flow of 2 million gallons/day. Negative attitudes among landowners were associated mostly with concern about the possible existence of heavy metals, the possible survival of pathogenic viruses and human parasites, and the effect of runoff on water quality. (Kreager-FIRL)  
W77-00046

**WASTES FIND FERTILE FIELD AS LOW-COST PLANT NUTRIENTS,**  
P. M. Kohn.  
Chemical Engineering, Vol. 83, No. 16, p 43-45, August 2, 1976. 1 fig.

Descriptors: \*Waste treatment, \*Sludge treatment, \*Fertilizers, \*Recycling, \*Symbiosis, Municipal wastes, Industrial wastes, Sludge treatment, Economics, Nitrogen, Phosphorus, Potassium, Chemical wastes.

Developments in the use of transformed liquid waste as fertilizer are reviewed along with problems hindering the increased recycling of such wastes. The city of Houston, Texas, is presently flash-drying its activated sludge to form a material called 'Hou-Actinite'. The product has a nitrogen-phosphorus-potassium analysis of 5-5-0 and is sold to Texas rice farmers, Florida citrus growers and others. Hou-Actinite sells at \$25-31/ton. Although this price brings no profit, the conversion of sludge to Hou-Actinite is preferable to using landfill as a disposal means. Pacific Disposal Systems, Incorporated, a firm that handles hazardous chemical wastes, plans to go onstream in the near future with a system that will convert waste nitric acid to ammonium nitrate which will be marketed as a fertilizer. Major drawbacks to the widespread use of wastes as fertilizers include their low nitrogen-phosphorus-potassium nutrient value, their high bulk and water content, and their variable quality. Also, the low value of such fertilizers makes their storage expense relatively high. (Kreager-FIRL)  
W77-00050

**RECENT ADVANCES IN SLUDGE TREATMENT AND DISPOSAL,**  
Department of the Environment, Ottawa (Ontario). Wastewater Technology Centre.  
For primary bibliographic entry see Field 5D.



## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5E—Ultimate Disposal Of Wastes

W77-00064

#### ECOLOGICALLY BALANCED COMMUNITY WASTEWATER DISPOSAL SYSTEMS MANAGEMENT FOR DEVELOPING COUNTRIES,

Jadavpur Univ., Calcutta (India).

For primary bibliographic entry see Field 5D.  
W77-00066

#### MATHEMATICAL MODEL FOR PREDICTING THE CONSOLIDATION OF DREDGED MATERIAL IN CONFINED DISPOSAL AREAS, Army Engineer Waterways Experiment Station, Vicksburg, Miss. Soils and Pavements Lab.

For primary bibliographic entry see Field 5B.  
W77-00167

#### DRAIN OIL DISPOSAL IN WISCONSIN, Wisconsin Dept. of Natural Resources, Madison.

For primary bibliographic entry see Field 5G.  
W77-00209

#### GROUND-WATER QUALITY IN THE DAVIE LANDFILL, BROWARD COUNTY, FLORIDA, Geological Survey, Tallahassee, Fla.

For primary bibliographic entry see Field 5B.  
W77-00486

### 5F. Water Treatment and Quality Alteration

#### FLOW APPROACHING FILTER WASHWATER TROUGHS, Camp, Dresser and McKee, Inc., Boston, Mass.

For primary bibliographic entry see Field 5D.  
W77-00053

#### POLYMERS PLAY INCREASED ROLE IN WATER CLARIFICATION, Calgon Corp., Pittsburgh, Pa.

For primary bibliographic entry see Field 5D.  
W77-00082

#### MANGANESE AND IRON REMOVAL FROM WATER BY ADSORPTION ON DIATOMACEOUS EARTH, Rhode Island Univ., Kingston. Dept. of Mechanical Engineering and Applied Mechanics.

F. J. DeLuise.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-258 776. Price codes: A02 in paper copy, A01 in microfiche. Completion Report, (1976). 13 p. 6 fig. 3 ref. OWRT A-053-R1(1). 14-34-0001-6041.

Descriptors: \*Manganese, \*Iron, \*Adsorption, Filtration, \*Diatomaceous earth, Oxidation, \*Water treatment, Methodology.

The removal of manganese from water supplies has always been a difficult practical problem because of the high filtration resistance caused by oxidized manganese. A method to reduce this resistance is investigated. Manganese and iron in water are oxidized under controlled conditions to form polymeric hydroxo complexes which are then adsorbed on diatomaceous earth and subsequently removed with the diatomaceous earth by a filtration process. Results with various grades and concentrations of diatomaceous earth are shown.

W77-00155

#### COMPARATIVE STUDIES ON THE ACTION OF CHLORINE AND OZONE ON

POLIOVIRUSES IN THE REPROCESSING OF DRINKING WATER IN ESSEN, (IN GERMAN), Essen Univ. (Gesamthochschule) (West Germany). Abteilung fuer Medizinische Virologie und Immunologie. O. Thraenhardt, and E. Kuwert. Zentralbl Bakteriell Parasitenkd Infektionskr Hyg Erste Abt Orig Reihe B Hyg Praev Med. 160(4/5), p 305-341, 1975.

Descriptors: \*Potable water, \*Chlorine, \*Ozone, \*Water treatment, \*Viruses, Analyses, \*Disinfection, Chlorination, Water pollution effects. Identifiers: Essen(Germany), Picornavirus, \*Polioviruses, Ozonation, \*West Germany.

Defined quantities of Cl and ozone were examined for their poliovirus-inactivating effect in water without redox potential double-distilled water, water with low defined redox potential (double-distilled water + KOH), previously chlorinated water with a residual Cl content of 0.03 mg Cl/l (tap water) and water with a high redox potential (well water from the drinking water plant). Cl and ozone are essentially equivalent disinfectants. The initial rate and the kinetics of virus disinfection are identical. The efficacy of both disinfectants is affected by the condition of the water (redox potential, pH, etc.). In Essen (West Germany) reservoir water, good virus disinfection can be had with 1.0-1.5 mg ozone/liter (dissolved); such a concentration guarantees very little residual ozone. Continuous checking of the redox potential and the amount of the ozone added is necessary. Ozonation of water, probably by the cleavage of humic acid, promotes bacterial recontamination of the drinking water in city taps. Pre-ozonation combined with subsequent chlorination would guarantee safety and aesthetic improvement of the drinking water. Such a combination would be feasible with highly reduced amounts of ozone and Cl.—Copyright 1976, Biological Abstracts, Inc.  
W77-00419

### 5G. Water Quality Control

THE USE OF CONTINUOUS SIMULATION IN THE EVALUATION OF WATER QUALITY MANAGEMENT PLANS, Hydrocomp, Inc., Palo Alto, Calif. A. S. Donigan, Jr., and R. K. Linsley. Available from the National Technical Information Service, Springfield, VA 22161 as PB-258 677. Price codes: A05 in paper copy, A01 in microfiche. Completion Report No. 7422, Aug 76. 85 p. 24 fig, 9 tab, 87 ref. OWRT C-6134(5215)(1).

Descriptors: \*Water quality, \*Planning, \*Project evaluation, \*Frequency analysis, Benefit cost analysis, Benefits, Damages, Probability, Mathematical models, Hydrologic models, Simulation analysis. Identifiers: Continuous simulation, Cost-effectiveness, Economic evaluation, Water quality modeling.

Demonstrated is a methodology for the evaluation of water quality plans analogous to procedures used in flood control planning, where flood damage frequency curves provide the basis for determining flood control benefits. The proposed methodology utilizes continuous water quality simulation to develop long term water quality information from which water quality frequency curves can be obtained. This frequency information allows the evaluation of the physical performance and impacts of proposed water quality control plans with specific consideration of the variable nature of the water resource. Using treatment costs and other economic indicators of water quality, the water quality frequency information can be used to estimate the cost-effectiveness and economic efficiency of alternative plans. The methodology is demonstrated in a typical urban environment; real hydrologic and climatic charac-

teristics are assigned to an assumed watershed configuration. Alternate waste treatment levels, in-stream aeration, flow augmentation, and non-point source control plans are simulated and analyzed for both physical and economic impacts. The advantages of continuous simulation and its use in water quality planning are explored.  
W77-00001

#### APPLICATION OF A HYDROLOGIC MODEL TO THE PLANNING AND DESIGN OF STORM DRAINAGE SYSTEMS FOR URBAN AREAS, Utah Water Research Lab., Logan.

For primary bibliographic entry see Field 4A.  
W77-00004

#### INSTITUTIONAL PROBLEMS OF THE SMALL TREATMENT PLANT, Environmental Quality Systems, Inc., Rockville, Md.

For primary bibliographic entry see Field 5D.  
W77-00010

#### A SLUDGE POLICY FOR THE 70'S, Environmental Protection Agency, San Francisco, Calif. Region IX.

For primary bibliographic entry see Field 5E.  
W77-00026

#### REMOVAL VS BENEFITS: IT CAN BE TOO COSTLY, Kansas City Water and Pollution Control Depts., Mo.

For primary bibliographic entry see Field 5D.  
W77-00044

#### BEFORE REMOVING NUTRIENTS...RE-ANALYZE LAKE TAHOE, Utah Water Research Lab., Logan.

For primary bibliographic entry see Field 5C.  
W77-00045

#### CAUSES AND ALTERNATIVE SOLUTIONS TO THE WATER QUALITY PROBLEMS OF BIG STONE LAKE, WESTERN MINNESOTA-NORTHEASTERN SOUTH DAKOTA, Midwest Research Inst., Kansas City, Mo.

For primary bibliographic entry see Field 5C.  
W77-00047

#### CLOSED LOOP HIERARCHICAL CONTROL FOR RIVER POLLUTION, Saint John's Coll., Cambridge (England). M. G. Singh, and M. Hassan.

Automatica, Vol. 12, No. 3, p 261-264, May, 1976. 3 fig, 3 tab, 11 ref.

Descriptors: \*Water pollution control, \*Rivers, \*Mathematical models, Biochemical oxygen demand, Dissolved oxygen, Water quality control, Surface waters, Simulation analysis.

A feedback solution is obtained for a two-polluter river pollution control problem using a hierarchical method. The hierarchical optimization algorithm uses continuous time No Delay, Pure Delay, and Distributed Delay models of the Cam River near Cambridge. All of the calculations are done off-line within a decentralized computational structure. The resulting constant gains provide optimal feedback control for any initial condition, and this control can be implemented on-line. The method is also demonstrated on a three-polluter Distributed Delay model. Various simulation studies on river pollution problems associated with biochemical oxygen demand and dissolved oxygen show the efficacy of the method for river pollution control. (Kreager-FIRL)  
W77-00051

**GUIDELINES FOR SEDIMENT CONTROL IN IRRIGATION RETURN FLOW.**

Agricultural Research Service, Kimberly, Idaho. Snake River Conservation Research Center. D.L. Carter.

Journal of Environmental Quality, Vol. 5, No. 2, p 119-124, April-June 1976. 1 tab, 17 ref.

Descriptors: \*Return flow, \*Erosion control, \*Irrigation water, \*Sediment control, \*Irrigation practices, Water quality, Agriculture, Runoff, Flow, Furrow irrigation, Erosion, Cultivation, Filtration.

Identifiers: Soil loss.

Sediments in irrigation return flows arise mostly from erosion in furrows during irrigation, and sediment concentrations vary widely from near zero to several thousand ppm. Reducing both erosion and runoff would decrease the sediment in return flows. Technology is available for reducing both erosion during irrigation and soil loss from the land, and for removing sediments from return flows. This technology was discussed, and the following guidelines were suggested: (1) Eliminate or reduce irrigation return flows when conditions permit using irrigation methods with little or no runoff. (2) Control the irrigation furrow slope so that the run is across the steepest slope or on the contour. Decrease the slope near the end of the furrow to reduce the flow velocity and increase sedimentation. (3) Control the furrow stream size and make proper stream adjustments. Adequate water measuring equipment and controls are essential for proper stream size control. (4) Shorten the run length. (5) Control the irrigation duration to reduce the number of irrigations per season. Alternate furrow irrigation reduces the contact between soil and flowing water and subsequent erosion. (6) Cultivate only when necessary, avoiding excessive soil loosening which increases erosion and soil loss. (7) Control tailwater by assuring that it flows slowly enough that sediments settle before the water leaves the field. Filtering through grass strips removes sediments. (8) Utilize sediment retention basins to remove sediment from return flows. (Lee-ISWS)

W77-00090

**PENNSYLVANIA TRIES NEW WATER QUALITY MANAGEMENT PLAN.**

Pennsylvania Dept. of Environmental Resources, Harrisburg.

B.J. Kampschroer.

Water and Sewage Works, January 1976. p 47-49. 6 fig.

Descriptors: \*Water resources planning, \*Water quality, \*Water management (Applied), \*Public participation, \*Pennsylvania, Planning, Economic feasibility, Social aspects, Institutions, Comprehensive planning.

Identifiers: \*Comprehensive Water Quality Management Planning Program (COWAMP), \*Waste water management.

The planning process of Pennsylvania's Comprehensive Water Quality Management Planning Program (COWAMP) is reviewed. The program encompasses all aspects of waste-water management and pollution control, including point and non-point sources of pollution, agricultural runoff, abandoned mine drainage, sludge disposal and groundwater quality protection. COWAMP, a three year program established in the Department of Environmental Resources in 1974, seeks to identify physical, financial, institutional and regulatory steps involved in formulating its water management plan which is due in 1977. COWAMP's goal is to formulate a feasible plan that will achieve and maintain surface and groundwater quality in an economically responsible manner, and consistent with other environmental goals. Data collection involved topography, geology and climate of the 9 study areas the state was divided into (along hydrological boundaries); surface and groundwater hydrology; population

figures and present land use; existing water quality standards and methods used in water quality management; and soil classification. From these data 2 projections were made: prediction of the future based on historical trends, and a projection considering special environmental concerns expressed by local study committees. A cooperative arrangement between regional planning agencies, consulting firms and the Department of Environmental Resources was established to encourage public participation. In this way communication was facilitated between local advisory committees and the state. (Gentry-North Carolina).

W77-00107

**A RELIABILITY ASSESSMENT FOR REGIONAL WATER QUALITY MANAGEMENT.**

Texas Univ., San Antonio. Div. of Environmental Studies.

C. S. Shih.

Computers and Operations Research, Vol 3, No 2/3, p 145-155, August 1976. 9 fig, 1 tab, 4 ref.

Descriptors: \*Water quality control, \*Reliability, \*Simulation analysis, \*Optimization, \*River basins, Management, Regional analysis, Assessment, Stochastic processes, Decision making, Streams, Waste water treatment, Annual, Operation and maintenance, Costs, Amortization, Equations, Mathematical models, Systems analysis, \*Texas.

Identifiers: \*Cost minimization, \*Stochastic quadratic programming, Transition functions, Chance constraints, Linear constraints, Multiple linear regression, Sensitivity analysis, \*San Antonio River Basin (Tex).

Deterministic criteria have always been employed in establishing managerial goals for urban water quality management. However, the different parameters, such as quantity and quality of waste treatment discharges, irrigation return flows and urban runoff, that characterize regional water quality are probabilistic in nature. Thus, the attainment of managerial goals will inherently exhibit the characteristics of uncertainty. Herein, the concept of reliability of water quality of a stream system is introduced. Reliability is defined as the percentage of time that specific water quality managerial goals can be attained. A simulation-optimization model has been developed for decision-making in regional water quality management. Stochastic quadratic programming techniques have been used in optimizing the basin-wide quality control strategy subject to a probabilistic constraint which reflects the desired reliability of the stream system. The optimization scheme facilitates the determination of the best pollution control decisions for each treatment facility while minimizing the total regional annual cost, subject to the quality criteria, and the desired level of reliability. Practical application of the model to the San Antonio River Basin, Texas, has been analyzed and a sensitivity analysis conducted which is based on varying degrees of the system reliability. (Bell-Cornell)

W77-00114

**ENVIRONMENTAL EFFECTS OF ALTERNATIVE ENERGY DEVELOPMENTS IN THE NORTHERN GREAT PLAINS.**

United Nations, New York.

For primary bibliographic entry see Field 6G.

W77-00115

**OR DATA BASE INTERFACE—AN APPLICATION TO POLLUTION CONTROL.**

Carnegie-Mellon Univ., Pittsburgh, Pa.

W. D. Haseman, C. Holsapple, and A. B.

Whinston.

Computers and Operations Research, Vol 3, No 2/3, p 229-240, August 1976. 8 fig, 15 ref.

Descriptors: \*Planning, \*Computers, \*Water quality, \*Management, \*Water pollution control,

Computer programs, Optimization, Simulation analysis, River basins, Costs, Economics, Mathematical models, Operations research.

Identifiers: \*Data base management system,

\*Query language.

A generalizing planning system (GPLAN) is presented which allows for a collection of operations research models to be easily integrated with a data base management system. An example is discussed dealing with a water pollution problem, which is analyzed for its structural complexity and informational requirements; a high level query language is discussed which allows a planner to use such a system without particular computer expertise. The technique presented provides participants in the planning process with information about the costs and water quality effects of alternative treatment strategies. The method has two aspects: (1) simulation, involving the capacity to determine the water quality characteristics implied by a given treatment strategy; and (2) optimization, to minimize the basin-wide treatment costs, subject to satisfaction of water quality goals. GPLAN is capable of supporting data bases and models for a wide variety of planning problems. (Bell-Cornell)

W77-00116

**OPTIMIZATION OF STATE WATER QUALITY MONITORING SYSTEMS.**

Environmental Research Lab., Corvallis. Oreg.

D. H. Lewis.

Computers and Operations Research, Vol 3, No 2/3, p 127-143, August 1976. 3 fig, 6 tab, 7 ref.

Descriptors: \*Water quality, \*Monitoring, \*Optimization, \*Water pollution control, Methodology, Networks, Sampling, Federal Water Pollution Control Act, Probability, Resource allocation, Effluents, Standards, River basins, Design, Computers, Operations research.

Identifiers: Steepest descent technique, Maximum marginal return, Wabash River (Ind Ill), Environmental cost minimization.

The water quality monitoring activities required of the States under the Federal Water Pollution Control Act Amendments (PL92-500) will require resources well beyond what is likely to be available, if current systems structures and operating procedures are followed. This paper describes some quantitative procedures developed to optimize monitoring resource allocation, with the goal of getting the greatest possible return on a limited monitoring budget. The ambient and effluent standards which form the basis of the monitoring system are described. Stochastic inputs to the river basin which lead to violations of these standards are identified, and progress in characterizing these variations mathematically is discussed. Quantitative priority-setting procedures for the two principal monitoring activities (ambient and effluent), which account for these stochastic inputs are reviewed. Both procedures are designed to tell the state agency planner where the next increment of resource should be expended to maximize alternative monitoring objective functions. Approaches to integrating these two primary monitoring functions and opportunities for further applications of operations research techniques to improve program effectiveness and efficiency are suggested. (Bell-Cornell)

W77-00120

**THE USE OF STOCHASTIC MODELS IN THE INTERPRETATION OF HISTORICAL DATA FROM SEWAGE TREATMENT PLANTS.**

Wisconsin Univ., Madison.

For primary bibliographic entry see Field 5D.

W77-00121

**SOME THOUGHTS ON ZERO DISCHARGE,**  
Monroe County Drain Commission, Mich.  
P. Fleming.

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5G—Water Quality Control

Engineering Issues, Journal of Professional Activities, Proceedings of the American Society of Civil Engineers, Vol. 102, No. E12, p 179-181, April 1976.

Descriptors: \*Water pollution, \*Sewage, \*Effluents, \*Natural resources, Archaeology, Ecology, Conservation, Legislation, Pollution abatement.

Identifiers: \*Federal laws, \*Professional activities, \*Zero discharge.

The concept of zero discharge, as presented in the Federal Water Pollution Control Act Amendments of 1972, Public Law 92-500, is based on a philosophy that man is basically not compatible with nature. The long-term effects of such a philosophy are difficult to see, but at best, little good can come from disenfranchising man from nature. As an alternative, the goal of water pollution abatement should be to seek ways in which the waste products of man's activity can be returned to the environmental cycle in a way that represents the best long-term interests of man. (Bell-Cornell)

W77-00125

#### INVESTIGATION OF BACTERIOLOGICAL POLLUTION OF RECREATIONAL WATERS IN ARIZONA

Arizona Univ., Tucson. Dept. of Watershed Management; and Arizona Univ., Tucson. School of Renewable Natural Resources.

For primary bibliographic entry see Field 5B.

W77-00153

#### SURFACE RUNOFF LOSSES OF FERTILIZER ELEMENTS

Louisiana State Univ., Baton Rouge. Dept. of Agronomy; and Louisiana Agricultural Experiment Station, Baton Rouge.

For primary bibliographic entry see Field 5B.

W77-00165

#### NITROGEN IN SUBSURFACE DISCHARGE FROM AGRICULTURAL WATERSHEDS

Agricultural Research Service, Columbia, Mo.

For primary bibliographic entry see Field 5B.

W77-00166

#### A REGIONAL MARKET FOR RIGHTS TO USER FERTILIZER AS A MEANS OF ACHIEVING WATER QUALITY STANDARDS

Illinois Univ. at Urbana-Champaign. Dept. of Agricultural Economics.

C.R. Taylor. Journal of Environmental Economics and Management, Vol. 2, No. 1, p. 7-17, 1975. 3 fig., 4 tab., 12 ref.

Descriptors: \*Control, \*Rates of application, \*Fertilizers, \*Permits, \*Taxes, Nitrogen, Nitrates, Nitrites, Water pollution control, Crop production, Illinois, Regional economics, Water quality. Identifiers: \*Fertilizer rights, \*Fertilizer excise tax.

The market for rights to use nitrogen fertilizer policy is compared with a fixed per unit excise tax on fertilizer and some effects of these nitrogenous fertilizer restrictions on crop production in Illinois are empirically examined. It is shown that the net effect of the two policies on production and distribution of income from production at a given point would be the same only if no rights were purchased by nonusers of fertilizer. However, there were three important differences: (1) Different options are available to nonusers to influence the amount of fertilizer used, (2) the effects of adapting the policies to annual changes in economic conditions and social values differ, and (3) the rights policy allows more precise control over the total amount of fertilizer used, which is particularly important if a water quality standard is

to be managed by controlling the use of fertilizer. Results also indicate that the use of a tax or rights policy in Illinois would increase nitrogen fertilizer use in other states, thus illustrating the need for a national coordination of fertilizer use policies. (Luedtke-Wisconsin)

W77-00173

#### OFFSHORE INDUSTRIAL-PORT ISLANDS

Delaware Univ., Newark. Coll. of Marine Studies.

R. B. Biggs.

Oceanus, Vol. 19, No. 1, p. 57-66, 1975.

Descriptors: \*Offshore platforms, \*Industrial plants, \*Islands, \*Design, Industrial wastes, Treatment facilities, Construction costs, Feasibility, Environmental effects, Legal aspects, Jurisdiction.

Identifiers: \*Artificial sea-islands.

Because many major United States industrial centers dependent on water transportation are sited on estuaries too shallow to handle modern ships, too small to assimilate wastes, and valuable as a biological-recreational resource, the concept of a multipurpose offshore industrial-port island is discussed. Based on criteria for selection of island candidates (importance of industry to national economy and defence; history of plant site acquisition problems; source, volume, and form of raw materials needed; noxious, nuisance, or hazardous nature of the industry; and whether the industry is labor or capital intensive), possible candidate industries considered are petroleum refining, petrochemical manufacturing, electric power generation (fossil and nuclear), deepwater terminals, liquefied natural gas regasification, urban solid-waste processing and disposal, fertilizer manufacturing, paper manufacturing, electrometals processing, iron reduction and steelmaking, and nuclear fuel reprocessing. A 500,000 barrel/day refinery core was selected as an example of a complex that could be constructed off the northeastern United States shore. The key input would be imported crude oil and/or oil produced in nearby offshore fields. Outputs would be refined petroleum products and petrochemicals. Construction design and costs, environmental effects, labor transportation, and legal-jurisdictional issues are discussed. (Buchanan-Davidson-Wisconsin)

W77-00176

#### BEWARE THE WRATH OF OSIRIS

For primary bibliographic entry see Field 4A.

W77-00177

#### CONCEPTUAL FRAMEWORK OF ENVIRONMENTAL MANAGEMENT

Cleveland Dept. of Public Utilities, Ohio. Div. of Utilities Engineering.

For primary bibliographic entry see Field 6G.

W77-00178

#### THE ENVIRONMENT AND THE STRUCTURE OF SOCIAL GOALS

J. Klackova.

Eastern European Economics, Vol. 14, No. 1, p. 88-113, 1975. 1 tab., 2 ref.

Descriptors: \*Pollution taxes (Charges), \*Systems analysis, Economics, Pollution abatement, Pricing, Environmental effects, Costs, Social aspects, Mathematical studies, Welfare (Economics), Economic rent.

Identifiers: \*Environmental quality, \*Czechoslovakia, Socialism.

The fundamental economic aspects of environmental conservation in a socialist society are analyzed from a theoretical point of view. The central issue is to learn to quantitatively measure the social utility of the natural environment, viewing it as an article of consumption. A simplified three-element vector is formulated relating

production, consumption, and environmental quality in a static situation. The environmental quality component is incorporated at the outset of the planning/decision making process and placed on the same level in the system of material incentives as the production/consumption activities. Financial payments for unit damage to the environment must equal the total social harm suffered by the community. In this way the effect of investment in reducing damage is evaluated at the level of enterprise decision making and the installation of pollution control equipment will figure as cost reduction due to lower payments for pollution. In practice, the use of the price system and fixed environmental standards will not necessarily guarantee a socially optimum allocation of activities. However, it is an acceptable method since it is demonstrated that a uniform payment rate for waste and injurious substances achieves the desired environmental goals at the lowest social cost. (Luedtke-Wisconsin)

W77-00181

#### SUBSTITUTE CHEMICAL PROGRAM: INITIAL SCIENTIFIC AND MINIECONOMIC REVIEW OF MALATHION

Midwest Research Inst., Kansas City, Mo.

For primary bibliographic entry see Field 5C.

W77-00192

#### THE BUDDING ENVIRONMENTAL CLEAN-UP (A VIEWPOINT): PART I. POLLUTION AND ENVIRONMENT

Bordeaux-1 Univ., Talence (France). Dept. of Geography.

R. H. Charlier, and M. Vigneaux.

International Journal of Environmental Studies, Vol. 8, No. 2, p. 121-136, 1975. 11 fig.

Descriptors: \*Environment, \*Pollution abatement, Foreign countries, Air pollution, Water pollution, Thermal pollution, Eutrophication, Surveys, Industrial production, Attitudes, Social aspects, Long-term planning, Projections.

This first of a two-part paper deals with worldwide environmental degradation and current and proposed solutions of the resultant problems. The reactions and interactions of environmental factors are examined and some blatant cases of pollution damage are cited. The concept of environment; the process of the universe; physical factors such as climates, air, water, and soil; social factors such as rural and urban habitats, means of transportation, and free time; adaptations, accommodation and modifications; together with the immoderate actions of man are considered. Specific instances of pollution problems in the United States, the area of the Caspian Sea, the Soviet Union, Belgium, Germany, and Italy are briefly stated. Recognition of these problems and various countermeasures being taken to correct them are also briefly mentioned. Possible solutions all point in the direction of education: humans must be reeducated in terms of values, needs, wants, unemployment, obsolescence rate, recycling of used raw materials, and a philosophical redirection of interests away from our consumer-oriented society. (Luedtke-Wisconsin)

W77-00194

#### EVALUATION OF MULTI-PURPOSE OFFSHORE INDUSTRIAL-PORT ISLANDS. VOL II: MAJOR RESEARCH PROBLEMS AND PROMISING RESEARCH APPROACHES

Delaware Univ., Newark. Coll. of Marine Studies.

For primary bibliographic entry see Field 8C.

W77-00199

#### DEVELOPING A TOTAL OIL SPILL CLEANUP CAPABILITY IN THE SAN FRANCISCO BAY AREA

Clean Bay Inc., Concord, Calif.

F. M. Smith.



In: Prevention and Control of Oil Spills, Proceedings of Joint Conference, Washington, DC, March 13-15, 1973, p 21-26, 7 fig, 5 ref.

Descriptors: \*California, \*Bays, \*Oil spills, \*Oil pollution, Water pollution, \*Water quality control, \*Pollution abatement, \*Skimming, Coasts, Accidents, Treatment, Separation techniques. Identifiers: \*Accident prevention, \*Oil booms, Pollution cleanup, Spill cleanup, San Francisco Bay, US West Coast, Clean up.

A progress report is given on the development of a total capability for rapid cleanup of oil spills in the Greater San Francisco Bay Area and 340 miles of ocean coastline outside the Bay by Clean Bay Inc., a ten-member non-profit corporation formed on July 1, 1971. CBI devised a three-phase Master Plan for completion by July 1, 1974; Evolved an oil spill contingency plan through testing and revision; Developed first aid capability available to each member facility for small spill cleanup; Fostered closer working relationships with other West Coast oil spill cooperatives; and Implemented a concerted approach to working with governmental agencies and environmental and wildlife organizations. Major emphasis was placed on preparedness for massive spills, with a supporting role in minor incidents in conjunction with the first aid capability of member companies. (See also W76-09312) (Sinha-OEIS) W77-00200

**SPILL PREVENTION—PHASE II,** Environmental Protection Agency, Washington, D.C. Div. of Oil and Hazardous Materials. H. D. Van Cleave.

In: Prevention and Control of Oil Spills, Proceedings of Joint Conference, Washington, D.C., March 13-15, 1973, p 27-29.

Descriptors: \*Oil spills, \*Oil pollution, \*Pollution abatement, \*Water quality control, Water pollution, \*Regulation, Transportation, Conservation, Safety factors, Navigation. Identifiers: \*Oil spill prevention, Accident prevention.

The EPA prevention program as it related to national oil spill problems is discussed. The national program revolves around the spill prevention, control and countermeasure (SPCC) concept which incorporates contingency planning, spill response and prevention into one single comprehensive program. This approach permits flexibility in design and encourages innovation so that each facility may develop an optimum plan to eliminate spills. It is recognized that a facility's age, location and function must be evaluated to determine the best balance between prevention measures and effective spill response. The first phase of this program was initiated through special provisions of the Refuse Act Permit Program. The program will be expanded with the promulgation of the oil prevention regulation which is being developed in accordance with Section 11(j)(1)(C) of the Federal Water Pollution Control Act as amended. (See also W76-09312) (Sinha-OEIS) W77-00201

**SPILL PREVENTION IN OFFSHORE PETROLEUM PRODUCING FACILITIES,** Exxon Co., Houston, Tex.

D. G. Warner. In: Prevention and Control of Oil Spills, Proceedings of Joint Conference, Washington, DC, March 13-15, 1973, p 31-37, 9 fig, 8 ref.

Descriptors: \*Offshore platforms, \*Oil industry, \*Oil pollution, Resources development, \*Water quality control, \*Pollution abatement, \*Safety factors, \*Regulation, Operations, Equipment, Accidents, Training, Personnel. Identifiers: Production facilities, \*Petroleum production, \*Offshore technology, Pollution control systems.

Spill prevention equipment and procedures using in offshore oil production are reviewed and the programs to achieve maximum protection by Exxon Company, U.S.A. and Industry are discussed. Several pollution prevention systems are utilized. Subsurface safety valves shut in the wells below the mud line if an emergency develops. Surface safety valves on each well provide automatic shut-in if an abnormal condition is detected by one of a large number of platform sensors. Oil leaks are retained in sumps. Sand erosion detectors are installed on wells to identify potential erosional failures before they can occur. It is concluded that various Industry and regulatory programs are providing the pollution control that is needed. Technological developments and reliability improvements are continuing. Ongoing work emphasizes development of improved subsurface safety valve concepts applicable to all wells, better manufacturing quality control and standards, and future reductions of human errors through training and safety programs. (See also W76-09312) W77-00202

**OIL SPILL PREVENTION MEASURES FOR THE TRANS-ALASKA PIPELINE SYSTEM,** Alyeska Pipeline Service Co., Houston, Tex. E. W. Wellbaum.

In: Prevention and Control of Oil Spills, Proceedings of Joint Conference, Washington, DC, March 13-15, 1973, p 39-43.

Descriptors: \*Pipelines, \*Oil spills, \*Oil pollution, \*Oil industry, Accidents, \*Earthquakes, \*Environmental effects, Resources development, \*Alaska, Safety factors, Natural resources, Weather, Hazards, Transportation, Planning. Identifiers: \*Trans-Alaska pipeline system, \*Production facilities, \*Petroleum production, Tankers, Spill prevention.

Alyeska Pipeline Service Company is responsible for design, construction, operation, and maintenance of the pipeline system which will move crude oil produced on the Alaskan North Slope along a route to Valdez, an ice free port located on an arm of Prince William Sound. At Valdez, the oil will be transferred to ocean going tankers. The amount of technical preplanning and the extent of environmental studies undertaken in preparation for this project are unprecedented. Oil spill contingency planning recognizes that despite the best efforts in design, construction, operation and maintenance, Alyeska must be prepared to handle an oil spill at any point on the system during its operating life. The maximum oil spill from complete separation of the pipeline will be limited by the placement of 136 check and remotely operated mainline valves. The maximum drainage after valve closure is 50,000 barrels and this can occur in only 1.5% of the line. The maximum drainage for over half of the line length is 15,000 barrels. Drainage basin studies are now being completed which will identify the route of flow of oil spills from each foot of the pipeline. Stream flow rates for summer, break-up, and floods are being determined so that the speed of the oil flow can be estimated. This data, along with snow, ice, and meteorological information will be stored in a computer data bank for use in generating oil spill response actions. Similar data is being collected for action plans for an oil spill in Port Valdez. It is Alyeska's intention to have oil spill contingency plans—which have been tested—completed on year before start-up of the system. (See also W76-09312) W77-00203

**COAST GUARD TRANSFER MONITORING PROGRAM,** Coast Guard, Washington, D. C. Marine Environmental Protection Div. For primary bibliographic entry see Field 5B. W77-00204

**DESIGN OF A REFINERY DOCK TO PREVENT OIL SPILLS,** Shell Oil Co., Wood River, Ill. Wood River Refinery.

L. D. Nieman, W. G. Cline, and C. R. Woodford. In: Prevention and Control of Oil Spills, Proceedings of Joint Conference, Washington, DC, March 13-15, 1973, p 53-59, 8 fig.

Descriptors: \*Oil spills, \*Oil pollution, Water pollution, \*Pollution abatement, \*Water quality control, Mississippi River, Resources development, Docks, \*Design. Identifiers: Floating docks, Petroleum, Fuel transfer.

The modern dock operated by Shell Oil Company as part of the Wood River Refinery in Illinois was designed to include features which minimize the possibility of oil spills. The dock is located on the Mississippi River near St. Louis. It is comprised of four floating sections and is designed to load and unload barges only. Solid pipe loading arms are used to make the connections between the floating dock manifold and the barge header. The primary loading valves on the floats can be operated manually or electrically from a local station or remotely from the dock control center. Each floating dock is equipped with a drainage system to prevent spillage into the river. An intercom system provides communication between the dock control center and the loading areas. The dock operator is also in direct radio and telephone contact with refinery operating personnel responsible for the transfer of oil. Operation of this facility has met the criteria of efficient operation and protection against spills. (See also W76-09312) (Sinha-OEIS) W77-00205

**A DUAL PROGRAM FOR PREVENTION OF OIL SPILLS IN OFFSHORE DRILLING AND PRODUCING OPERATIONS,** Shell Oil Co., New Orleans, La. R. L. Wilson, and O. J. Shirley.

In: Prevention and Control of Oil Spills, Proceedings of Joint Conference, Washington, DC, March 13-15, 1973, p 61-63.

Descriptors: \*Oil spills, \*Oil pollution, \*Offshore platforms, \*Water quality control, \*Pollution abatement, Drilling, Accidents, Gulf of Mexico, Resources development, Safety, Operation and maintenance, Continental Shelf. Identifiers: \*Outer Continental Shelf, Waterways, Personnel training, Production activities, Equipment failure, Human error, Offshore technology.

Virtually all oil spills resulting from oil drilling and production activities in the Nation's waterways are caused by accidents. Therefore it follows that prevention of accidents and prevention of oil spills are synonymous objectives. Accidents can be broadly classified into two categories, that is those caused by equipment failure and those caused by human error. A program for accident prevention addressing both causes was developed and has now been fully implemented throughout Shell Oil Company's offshore operations in the Gulf of Mexico. (See also W76-09312) (Sinha-OEIS) W77-00206

**PREVENTION—THE BEST METHOD OF CONTROLLING POLLUTION,** Sun Oil Co., Dallas, Tex.

F. C. Folger, Jr. In: Prevention and Control of Oil Spills, Proceedings of Joint Conference, Washington, DC, March 13-15, 1973, p 65-67.

Descriptors: \*Oil spills, \*Oil pollution, \*Pollution abatement, \*Offshore platforms, \*Water quality control, Accidents, Environmental engineering drilling, Operation and Maintenance, Testing. Identifiers: Personnel training, Equipment design, Production operations.

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5G—Water Quality Control

The primary objective of an environmental management program must be to prevent pollution. The techniques and procedures which are practical, readily applied, and easily administered are discussed. They can be incorporated into day-to-day operations with no disruption, and a minimum of additional effort. Equipment design (with particular respect to whether or not original design is still suitable for current operating conditions), alarm and shut-down systems, inspection and testing, maintenance, and operation are considered. Also considered are personnel training, definition of duties and responsibilities, and interdependence of personnel to achieve a common objective. (See also W76-09312) (Sinha-OEIS) W77-00207

**PREVENTION IS BEST,**  
Union Oil Co. of California, Los Angeles.  
G. H. Hemmen.

In: Prevention and Control of Oil Spills, Proceedings of Joint Conference, Washington, DC, March 13-15, 1975. p 69-71.

Descriptors: \*Oil spills, \*Oil pollution, \*Operation and Maintenance, \*Pollution abatement, \*Water quality control, Environmental effects, Oil industry, Oily wastes, Equipment, Accidents, Cathodic protection.  
Identifiers: Petroleum.

The history of the development of fiberglass reinforced plastic tanks, tank testing equipment, line leak detectors, pre-engineered cathodic protection systems and wrapping are reviewed. The extent of usage by marketers together with pros and cons are indicated. Various approaches directed towards the safe disposition of waste oils are reviewed along with a description of the joint industry efforts underway to find new and better ways of achieving ecologically sound means of handling this problem. In addition to the preventive type of action, a brief discussion of emergency procedures is given. (See also W76-09312) (Sinha-OEIS) W77-00208

**DRAIN OIL DISPOSAL IN WISCONSIN,**  
Wisconsin Dept. of Natural Resources, Madison.  
R. O. Ostrander, and S. J. Kleiner.  
In: Prevention and Control of Oil Spills, Proceedings of Joint Conference, Washington, DC, March 13-15, 1973. p 73-78, 3 fig, 2 tab, 7 ref.

Descriptors: \*Oil pollution, \*Waste disposal, \*Oil wastes, \*Pollution abatement, Water pollution, \*Environmental effects, \*Wisconsin, Resources, Recycling.  
Identifiers: \*Drain oil disposal, Pollution prevention.

Service stations handle from 55 to 65% of the oil drained from cranks in Wisconsin. Of this, 97.6% is re-used as lube oil, fuel oil, road oil or on farms. The remaining 2.4% is wasted but much of this is hauled to licensed disposal sites. For best use of a limited resource, drain oil should be re-refined as lube oil. Increased re-refining should be encouraged. A random sampling to determine the fate of oil drained by individuals is recommended so that we may have answers to this important segment of the overall problem. (See also W76-09312) (Sinha-OEIS) W77-00209

**OIL SPILL PREVENTION PRACTICES IN PIPELINES AND TERMINALS,**  
Sohio Pipe Line Corp., Cleveland, Ohio.  
O. M. Turner.

In: Prevention and Control of Oil Spills, Proceedings of Joint Conference, Washington, DC, March 13-15, 1973. p 79-84, 11 fig.

Descriptors: \*Oil spills, \*Oil pollution, \*Pollution abatement, \*Pipelines, Storage tanks.

Identifiers: Personnel training, Terminal facilities, Terminals, Cargo transfer, Containment.

Today, more than 200,000 miles of oil pipelines link a half-million oil wells with two hundred and fifty refineries and thousands of distribution terminals across the country. The petroleum industry goes to great lengths to assure the safety and reliability of its pipeline systems and terminal facilities. Both types of facilities require heavy capital investment, and both handle a commodity which is flammable. Routine petroleum transportation and storage practices have one major goal—product containment. Operating efficiency, safety, and pollution prevention are synonymous in pipeline transportation and storage, since the necessary goals in all three areas are achieved by containing the petroleum being transferred or stored. The industry lays no claim to perfection. But it has made remarkable progress in creating and employing preventive techniques and equipment—both in pipelines and in terminals. (See also W76-09312) (Sinha-OEIS) W77-00210

**TAGGING OIL-RESIDUES IN TANKERS WITH MICROPARTICLES,**  
Swedish Investigation Committee for Methods of Tagging Oil in Ships, Stockholm.  
For primary bibliographic entry see Field 5A. W77-00211

**THE VISIBILITY OF OIL-WATER DISCHARGES,**  
National Environmental Research Center, Edison, N. J. Edison Water Quality Research Div.  
For primary bibliographic entry see Field 5B. W77-00212

**THE DEVELOPMENT OF AN EXPERIMENTAL AIRBORNE LASER OIL SPILL REMOTE SENSING SYSTEM,**  
Transportation Systems Center, Cambridge, Mass.  
For primary bibliographic entry see Field 5A. W77-00213

**VOLUMETRIC DETERMINATION OF MARINE OIL SPILLS USING COORDINATED AIRBORNE AND SURFACE SAMPLING DATA,**  
California Univ. Santa Barbara.  
For primary bibliographic entry see Field 5A. W77-00214

**DEVELOPMENT OF U.S. COAST GUARD PROTOTYPE AIRBORNE OIL SURVEILLANCE SYSTEM,**  
Coast Guard, Washington, D. C.; and Aerojet ElectroSystems Co. Azusa, Calif.  
For primary bibliographic entry see Field 5A. W77-00215

**REMOTE SAMPLER FOR DETERMINING RESIDUAL OIL CONTENT OF SURFACE WATERS,**  
Naval Ship Research and Development Center, Annapolis, MD.  
For primary bibliographic entry see Field 5A. W77-00216

**AN OPTIMAL PREVENTION AND DETECTION MODEL FOR POLLUTION PATROL,**  
Purdue Univ., Lafayette, Ind. School of Industrial Engineering.  
For primary bibliographic entry see Field 5A. W77-00217

**OIL SPILL-SOURCE CORRELATION BY GAS CHROMATOGRAPHY: AN EXPERIMENTAL EVALUATION OF SYSTEM PERFORMANCE,**  
Woods Hole Oceanographic Institution, Mass.

For primary bibliographic entry see Field 5A. W77-00218

**TECHNIQUES FOR ANALYSIS OF PARAFFIN HYDROCARBONS AND FOR INTERPRETATION OF DATA TO ASSESS OIL SPILL EFFECTS IN AQUATIC ORGANISMS,**  
National Marine Fisheries Service, Seattle, Wash. Northwest Fisheries Center.  
For primary bibliographic entry see Field 5A. W77-00219

**DETERMINATION OF N-ALKANE AND METHYLNAPHTHALENE COMPOUNDS IN SHELLFISH,**  
Battelle-Pacific Northwest Labs., Richland, Wash.  
For primary bibliographic entry see Field 5A. W77-00220

**IDENTIFICATION OF OIL POLLUTANTS: A REVIEW OF SOME RECENT METHODS,**  
National Environmental Research Center, Edison, N. J. Edison Water Quality Research Div.  
For primary bibliographic entry see Field 5A. W77-00221

**A MULTIPARAMETER OIL POLLUTION SOURCE IDENTIFICATION SYSTEM,**  
Phillips Petroleum Co., Bartlesville, Okla. Research Div.  
For primary bibliographic entry see Field 5A. W77-00222

**CHARACTERISTICS OF NATURALLY OCCURRING AND POLLUTANT HYDROCARBONS IN MARINE SEDIMENTS,**  
Paris Univ. (France).  
For primary bibliographic entry see Field 5A. W77-00223

**COMPARATIVE IDENTIFICATION OF OIL SPILLS BY FLUORESCENCE SPECTROSCOPY FINGERPRINTING,**  
Environmental Protection Agency, Edison, N. J. Surveillance and Analysis Div.; and Environmental Protection Agency, Edison, N. J. Region II.  
For primary bibliographic entry see Field 5A. W77-00224

**LABORATORY AND FIELD TESTING OF SURFACE-FILM FORMING CHEMICALS FOR USE AS OIL COLLECTING AGENTS,**  
Naval Research Lab., Washington, D. C.  
For primary bibliographic entry see Field 5B. W77-00226

**DEVELOPMENT OF THE 'NEXT GENERATION' CHEMICAL DISPERSANTS,**  
Exxon Research and Engineering Co., Florham Park, N. J.  
G. P. Canevari.  
In: Prevention and Control of Oil Spills, Proceedings of Joint Conference, Washington, DC, March 13-15, 1973. p 231-240, 10 fig, 15 ref.

Descriptors: \*Oil spills, \*Oil pollution, Water pollution, \*Water quality control, Quality control, \*Dispersion, Chemical reactions.  
Identifiers: \*Outer Continental Shelf, Chemical dispersants, Biological effects, Drop size.

Despite the limitations of the mixing energy requirement, significant use of chemical dispersants continues where their use, due to conditions such as inability to recover oil, is appropriate and in adherence to regulatory agencies. Also continuing are extensive laboratory studies to resolve the biological effects, particularly long term, of dispersed oil. Biological field surveys of several

recent major applications indicated that there was little or no evidence of detrimental effects but more studies of this type are needed. The capability of chemical dispersion, as an approach to handle oil spills under those conditions where oil recovery is not possible, will be increased by orders of magnitude by the elimination of mixing energy. This is the indicated approach for the 'next generation' dispersants. Technical feasibility for these no or low mixing chemicals is shown. The basic differences between these systems and convention systems were identified. Based on the characteristics of the dispersant systems under development, e.g., submicron droplets, the environmental impact of these much finer droplets represent the remaining major considerations. (See also W76-09312) (Sinha-OEIS) W77-00227

#### ENGINEERING STUDY OF AN OIL GELLATION TECHNIQUE TO CONTROL SPILLS FROM DISTRESSED TANKERS,

Exxon Research and Engineering Co., Florham Park, N.J.  
A. M. Goldstein, R. M. Koros, and B. L. Tarmy.  
In: Prevention and Control of Oil Spills, Proceedings of Joint Conference, Washington, DC March 13-15, 1973. p 247-253, 6 fig, 17 ref.

Descriptors: \*Oil spills, \*Oil pollution, Water pollution, \*Water quality control, \*Pollution abatement, \*Gels, \*Rheology.  
Identifiers: \*Outer Continental Shelf, Gellation, Crude oil, Tankers, Engineering design.

Crude oil gellation is a potentially attractive technique for minimizing or preventing the loss of oil from a distressed tanker by converting the liquid oil into a rigid solid. The procedure involves the chemical reaction of two organic liquid gelling agents dissolved in the oil to form a gelant compound which entraps the oil. The resulting gel would float as a coherent mass if it were extruded from a ship or escape as a result of tanker break-up. This paper presents the results of a program undertaken to demonstrate in situ gellation on a large scale, and to gather engineering design information for this technique. Engineering design data gathered include the effect of mixing energy, mixing time, gellation time and temperature on gel strength. In addition, rheological properties of the gel were examined to relate gel strength to the maximum fluid static head that may be maintained without flow through a certain hull hole. Details of a gellation test with 500 bbl of South Louisiana crude oil are discussed. This work forms the basis for the further efforts on equipment development, selection and evaluation required before this technique can be used in the field. (See also W76-09312) (Sinha-OEIS) W77-00228

#### THE TOXICITY TESTING OF OILS AND DISPERSANTS: A EUROPEAN VIEW,

Ministry of Agriculture, Fisheries and Food, London (England).  
K. W. Wilson, E. B. Cowell, and L. R. Beynon.  
In: Prevention and Control of Oil Spills, Proceedings of Joint Conference, Washington, DC, March 13-15, 1973. p 255-261, 2 tab, 32 ref.

Descriptors: \*Toxicity, \*Oil spills, \*Oil pollution, Water pollution, \*Water quality control, \*Pollution abatement, \*Environmental effects, Dispersion, Ecosystems.  
Identifiers: \*Outer Continental Shelf, \*Dispersants, \*Ecological effects.

A review of European approaches to the purpose and problems of testing the toxicity of hydrocarbons and dispersants is presented. The paper deals with the aims of toxicity tests, and draws distinctions between those devised for toxicity ranking purposes, required by governments and industry for assessing the potential of new products, and those tests done for predicting possible ecological

effects from the spillage or oil or use of dispersants. In discussing laboratory practice, chemical problems, standardisation, the selection of test organisms, sampling, experimental design data processing and data presentation are considered. (See also W76-09312) (Sinha-OEIS) W77-00229

#### BEHAVIORAL CHARACTERISTICS AND CLEANUP TECHNIQUES OF NORTH SLOPE CRUDE OIL IN AN ARCTIC WINTER ENVIRONMENT,

Department of Transportation, Washington, D.C.; and Coast Guard, Washington, D.C.  
T. J. McMinn, and P. Golden.

In: Prevention and Control of Oil Spills, Proceedings of Joint Conference, Washington, DC, March 13-15, 1973. p 263-276, 14 fig, 2 tab, 9 ref, 3 append.

Descriptors: \*Oil spills, \*Oil pollution, \*Pollution abatement, \*Environmental effects, \*Ice, Quality control, Gravity, Surfactants.  
Identifiers: \*Outer Continental Shelf, \*Oil-ice interaction, North Slope, Arctic, Bering Sea, Dispersants, Sorbents.

This paper deals with the physical fate and behavior of crude oil when spilled on winter arctic ice and snow surfaces. The concepts and theories developed are a result of a series of experiments performed by Coast Guard personnel in the Alaskan arctic during January-February 1972. Spreading and aging of oil on ice and snow, the unique interaction phenomena of snow and crude oil, and effectiveness of various cleanup techniques attempted on crude spilled on snow and ice are considered. Oil spreading over ice and snow is largely unaffected by oil properties such as density, viscosity, and surface tension. Oil spreading rate is also believed not to be a function of ambient air temperatures. Terminal spreading limit, independent of oil properties, is a function of effective surface roughness and volume of oil spilled. Oil was found to age on arctic ice. The winter aging rate was found to be significant although reduced from summer aging rates. Migration of oil into the ice or snow surface is minimal. However, snow falling on the surface of a freshly spilled oil pool migrates into the oil forming a mixture that contains up to 80% snow (by volume). An array of sorbents, surfactants, and dispersants were tested with largely negative results. (See also W76-09312) (Sinha-OEIS) W77-00230

#### DEVELOPMENT OF A POLYURETHANE FOAM MARINE OIL RECOVERY SYSTEM,

Shell Development Co., Houston, Tex. Pipeline Research and Development Lab.

J. P. Oxenham, R. A. Cochran, D. P. Hemphill, and J. P. Fraser.  
In: Prevention and Control of Oil Spills, Proceedings of Joint Conference, Washington, DC, March 13-15, 1973. p 277-289, 20 fig, 6 tab, 4 ref.

Descriptors: \*Oil spills, \*Oil pollution, \*Pollution abatement, \*Environmental effects, \*Water quality control, Equipment.  
Identifiers: \*Outer Continental Shelf, Sorbents, Polyurethane foam, Oil booms, \*Oil recovery.

A system has been developed for recovering spilled oil from water, under a wide variety of environmental conditions and for all types of oils, at rates up to 9,000 gal/hr. This system is based on the use of polyurethane foam, foamed on the job site, as a sorbent for the spilled oil. The foam is recirculated to increase efficiency and to lower unit costs. Equipment needed includes collection booms, an open-mesh chainlink belt for harvesting the oil-soaked sorbent, and a roller-wringer to remove oil and water from the foam. The foam is initially comminuted and distributed onto the water by means of a hay blower (mulcher), and

recycled pneumatically or by mechanical conveyor. Recovered oil and water are transported to shore for further treatment prior to disposal. Used foam is disposed of by incineration. (See also W76-09312) (Sinha-OEIS) W77-00231

#### DEVELOPMENT AND PRELIMINARY DESIGN OF A SORBENT OIL RECOVERY SYSTEM,

Hydronautics, Inc., Laurel, Md.  
E. R. Miller, Jr.  
In: Prevention and Control of Oil Spills, Proceedings of Joint Conference, Washington, DC, March 13-15, 1973. p 291-307, 18 fig, 7 tab, 1 ref.

Descriptors: \*Oil spills, \*Oil pollution, \*Water quality control, Water pollution, Water treatment, Equipment, Design criteria.  
Identifiers: \*Outer Continental Shelf, Oil recovery, Sorbents.

The development and preliminary design of a sorbent oil recovery system was carried out under contract to the EPA. The system is based on the use of open-cell reticulated polyurethane foam sorbent material. This material may be regenerated for use in a continuous system by mechanical squeezing. The development program included studies of the sorbent performance, the broadcasting system, the harvesting conveyor, the sorbent regenerator and the recovery platform performance. The results of the development program showed that an oil recovery system based on the continuous reuse of the sorbent material is feasible. Based on the data developed, a preliminary design for a 3000 GPH recovery system for protected waters was prepared. (See also W76-09312) (Sinha-OEIS) W77-00232

#### SORBENT SYSTEM DEVELOPMENT FOR OIL SPILL CLEANUP,

National Environmental Research Center, Edison, N. J. Edison Water Quality Research Div.  
J. S. Dorrlor.

In: Prevention and Control of Oil Spills, Proceedings of Joint Conference, Washington, DC, March 13-15, 1973. p 309-314, 8 tab, 7 ref.

Descriptors: \*Oil spills, \*Oil pollution, \*Pollution abatement, \*Water quality control.  
Identifiers: \*Outer Continental Shelf, \*Wave action, \*Wind effects, Sorbents.

Analysis of the research results indicate that mechanical sorbent systems can be used efficiently and effectively to recover spilled oil. Recovery efficiencies better than 90% can be expected. Within design limitations, wave action will have little effect on oil-sorbent recovery. In practice, wave action actually increases oil removal rates by bringing the oil into more intimate contact with the sorbent. Wind will produce detrimental effects on the broadcasting unit operation. These effects can be minimized by proper field operating techniques. (See also W76-09312) (Sinha-OEIS) W77-00233

#### NEW DEVICE FOR REMOVING OIL SLICKS FROM THE SURFACE OF WATER,

Battelle Inst., Geneva (Switzerland).  
J. J. Asper, and P. Bolli.  
In: Prevention and Control of Oil Spills, Proceedings of Joint Conference, Washington, DC, March 13-15, 1973. p 315-332, 29 fig, 2 ref.

Descriptors: \*Oil spills, \*Oil pollution, \*Water quality control, Equipment, Pollution abatement, \*Patents, Separation techniques.  
Identifiers: \*Outer Continental Shelf, \*Variable pitch screw, Oil slicks, \*Oil recovery.

In an analytical study of devices designed to remove oil slicks floating on water, the conclusion



## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5G—Water Quality Control

was that the majority of existing devices are not easily adaptable to marine operation. To overcome this disadvantage, Battelle has conceived a new device. The system is composed of a rotating, multi-thread screw in a casing. The oil and water enter the system at a given speed and are trapped between the threads. As the pitch of the threads progressively diminishes, the oil thickens and is removed by a pump from a chamber situated at the end of the screw, while the water is removed through an aperture below the screw casing. Disordered motion of the waves is absorbed by the last stage of the screw and the whole device follows the movement of the swell. This paper also describes the related laboratory development work and data on the performance of the device. The Patent Service of Battelle-Geneva has filed U.S. patent application No. 258,242 dated 31/5/72, relative to the invention which is the subject of this paper in the name of SEACLEAN S.A. Patents have also been applied for in most maritime countries, in most countries having lakes and large waterways, and in other industrialized countries. (See also W76-09312) (Sinha-OEIS) W77-00234

#### FREE VORTEX RECOVERY OF FLOATING OIL.

Scientific Associates, Inc., Santa Monica, Calif. E. B. Nebeker, S. E. Rodriguez, and P. G. Mikolaj. In: Prevention and Control of Oil Spills, Proceedings of Joint Conference, Washington, DC, March 13-15, 1973. p 333-338, 5 fig, 1 tab, 9 ref. DOT-CG-22878-A.

Descriptors: \*Oil spills, \*Oil pollution, \*Pollution abatement, \*Water quality control, \*Water pollution, \*Skimming, Prototype tests, Equipment. Identifiers: \*Outer Continental Shelf, Crude oil, Fuel oil, Free Vortex, Sorbents, Vortex skimmer, \*Oil recovery.

A technique using a free vortex to recover oil from high sea, stream, and harbor waters is presented. An oil slick will be drawn into the center of the vortex due to water flow induced by an impeller and other rotating hardware. As a result, a significant 'captive radius' is demonstrated which draws in oil from appreciable distances from the device—useful around piers, ships, etc., in harbors. Upon approaching the vortex, the oil will submerge and accumulate within a center region of the vortex. This pocket will contain a concentrated mass of oil which can be removed by conventional pumping. Since oil collection is not directly performed by hardware, but rather by the induced vortex flow, essentially the same hardware was also used to collect sorbent materials of various sizes and shapes. Tests were performed with a free vortex oil recovery device having an impeller diameter of two feet. Performance data were obtained both under quiescent water conditions and also under environmental conditions that simulated a severe sea state four with 20 knot winds and two knot currents. Oil recovery rates and oil/water ratios are reported for oil film thickness ranging between 1/16 to one inch thick using No. 2 Fuel Oil, Heavy Crude Oil, and a Residual Fuel Oil. (See also W76-09312) (Sinha-OEIS) W77-00235

#### HIGH SEAS OIL RECOVERY SYSTEM,

Ocean Systems, Inc., Reston, Va. F. A. March, and R. L. Beach. In: Prevention and Control of Oil Spills, Proceedings of Joint Conference, Washington, DC, March 13-15, 1973. p 339-350, 10 fig, 7 ref.

Descriptors: \*Oil spills, \*Oil pollution, \*Pollution abatement, \*Water quality control, \*Water pollution, \*Prototype tests, Equipment weirs, Testing. Identifiers: \*Outer Continental Shelf, Pollution prevention, Scale models, Model tests, Oil booms, \*Oil recovery.

A system for recovery of petroleum products from accidental offshore spills was developed and tested. The testing included both model testing and full scale testing of a 60 foot long system capable of recovering oil at a rate of 2,000 gal/min. The oil recovery rate is relatively independent of wind and wave conditions, surface temperature, oil specific gravity, oil-water interfacial tension and significant oil type variation. It is not affected by viscosity except for discharge hose pressure limitations above 10,000 SSU. The oil recovery system is air and truck transportable for rapid deployment to a remote spill location. It is completely self-contained having its own power unit, control system, and pumps. In its preferred deployment configuration it is used with oil containment booms for funneling the oil to the recovery system. A double weir system is employed to obtain the high performance of the system. The system is operated in such a way that oil thickens in front of the primary weir and then further thickens in front of the secondary weir, where it is withdrawn. Typically, the system concentrates free slicks from a thickness of 0.1 inches or less to a depth of approximately two feet in front of the secondary weir. The testing reported upon includes both model testing and full scale testing of the system. (See also W76-09312) (Sinha-OEIS) W77-00236

#### OIL RECOVERY ON THE HIGH SEAS,

Coast Guard Research and Development Center, Groton, Conn. J. T. Leigh. In: Prevention and Control of Oil Spills, Proceedings of Joint Conference, Washington, DC, March 13-15, 1973. p 351-360, 3 fig, 9 ref.

Descriptors: \*Oil spills, \*Oil pollution, \*Water quality control, \*Water pollution, \*Pollution abatement, \*Prototype tests, \*Environmental effects, Viscosity, Equipment. Identifiers: \*Outer Continental Shelf, Oil booms, \*Oil recovery, Disc drum recovery system, Wave conforming weirs.

Two prototype oil recovery systems currently under construction are described. Design goals for the systems include air transportability, recovery of a complete range of oil types at 2000 gpm in a sea state 4, use with a Coast Guard developed boom and Coast Guard boats and ships. One system utilizes a rotating disc-drum for oil removal. The drum is mounted in a unique catamaran which utilizes inflatable pontoon hull sections. Oil recovery rate is dependent on viscosity, slick thickness, current and wave conditions. In all conditions efficiency is expected to approach 100 percent. The second system utilizes a wave conforming weirbasin. Oil recovery rate is primarily dependent on slick thickness and current. Efficiency is expected to approach 100 percent for all conditions. (See also W76-09312) (Sinha-OEIS) W77-00237

#### OIL SPILL CONTAINMENT SYSTEM DEVELOPMENT AND TESTING PROGRAM,

Coast Guard, Washington, D.C. R. N. Abrahams, and E. R. Miller, Jr. In: Prevention and Control of Oil Spills, Proceedings of Joint Conference, Washington, DC, March 13-15, 1973. p 361-374, 15 fig.

Descriptors: \*Oil spills, \*Oil pollution, \*Pollution abatement, \*Water quality control, \*Water pollution, \*Prototype tests, Barriers, Tests, Equipment. Identifiers: \*Outer Continental Shelf, \*Oil slicks, \*Containment barriers.

A prototype high seas oil containment barrier and interim air delivery system was constructed. Full size high seas field testing both with and without oil was conducted. A brief review of the containment barrier design features and development program is presented. A major part of the develop-

ment program involved field testing. The procedures and instrumentation used for the field tests are described. The results from the oil containment tests in calm water and waves are presented in detail with qualitative and quantitative data on oil loss mechanisms and rates. (See also W76-05312) (Sinha-OEIS) W77-00238

#### PHYSICAL REQUIREMENTS FOR OIL POLLUTION CONTROL BARRIERS,

Massachusetts Inst. of Tech. Cambridge. Dept. of Ocean Engineering. J. H. Milgram.

In: Prevention and Control of Oil Spills, Proceedings of Joint Conference, Washington, DC, March 13-15, 1973. p 375-381, 6 fig, 4 ref.

Descriptors: \*Oil spills, \*Oil pollution, \*Water quality control, \*Water pollution, \*Barriers, \*Pollution abatement, Equipment, Model studies, Prototype tests. Identifiers: \*Outer Continental Shelf, Wave action, Wind effects.

An oil pollution control barrier must have adequate strength to withstand wave and current forces in the sea. In addition to this, it must be adequately strong to withstand nonoperating loads such as those encountered in construction, packaging, launching, recovery and refurbishment for further use. The barrier must have seakeeping responses which are correct for the purpose of containing oil. Sway response of a barrier is needed to avoid large relative flow velocities in waves. Heavy response is needed so that the relative height of the oil on the barrier will not become too large allowing oil to pass over the barrier or become too low and allow oil to pass beneath the barrier. The roll angle of the barrier must be relatively small to prevent leakage as well. The above factors are considered in this paper. This consideration is based on full scale trials of barriers, theoretical studies and model tests. (See also W76-09312) (Sinha-OEIS) W77-00239

#### MECHANICAL CONTROL OF OIL SPILLS UTILIZING A STREAMLINED BOOM,

Ultrasystems, Inc., Newport Beach, Calif. D. C. Wooten.

In: Prevention and Control of Oil Spills, Proceedings of Joint Conference, Washington, DC, March 13-15, 1973. p 383-389, 6 fig, 1 tab, 4 ref. EPA-68-01-0182.

Descriptors: \*Oil spills, \*Oil pollution, \*Water quality control, \*Pollution abatement, \*Model studies, \*Prototype tests, Equipment. Identifiers: \*Outer Continental Shelf, Bow waves, \*Oil booms, Wave action, Current action.

Conventional oil retention booms fail to contain oil in currents above one to two knots. A streamlined boom to operate in currents or while being towed in excess of two knots was designed and tested under varying current and combined wave-current conditions. The boom consists of airfoil-shaped sections which resemble hydrofoils operating at the water surface. The boom is designed so that the stagnation streamline at the leading edge of the foil is located beneath the oil spill under a range of dynamic current and wave conditions. Motion of the boom through the water (or the flow past the boom due to a net current) causes a bow wave which sweeps oil and water over the top of the leading edge of the boom and into a sump. Tests indicated that the streamlined boom profile has a drag coefficient of less than one-third that of conventional boom shapes. Collection efficiency measurements with oil indicate that collection efficiencies greater than 75% can be achieved at three knots. (See also W76-09312) (Sinha-OEIS) W77-00240

**ANALYTICAL OIL/WATER COALESCENCE**, David W. Taylor Naval Ship Research and Development Center, Annapolis, Md. S. M. Finger, and T. S. Yu.  
In: Prevention and Control of Oil Spills, Proceedings of Joint Conference, Washington, DC, March 13-15, 1973. p. 403-408, 10 fig, 2 ref.

Descriptors: \*Oil spills, \*Oil pollution, \*Pollution abatement, \*Water quality control, Water pollution, \*Oily water, \*Coalescence, \*Separation techniques.  
Identifiers: \*Outer Continental Shelf, Bilge, Ballast water.

The physical separation process of coalescence has been studied analytically under controlled conditions in regard to the separation of oil from oily water mixtures. Variations in coalescer performance were studied as a function of the oily water feed to a three stage prototype separation system of which coalescence was the final stage. The data were analyzed statistically and it was shown that increasing suspended solids concentration, increasing oil viscosity, and increasing oil concentration decreased coalescer element lifetime, however, above a certain level increasing oil concentration had no effect. Variations in the total flow rate in the range of one to four gallons per minute per square foot did not have a significant effect on coalescer element life. Under all conditions studied, the effluent water contained less than 15 parts per million oil, only ten percent of the samples analyzed contained more than this amount. The results indicate that coalescence is useful as a final polishing step in an oil/water separation system. (See also W76-09312) (Sinha-OEIS)  
W77-00241

**EVALUATION OF A UNIQUE CENTRIFUGE FOR SEPARATION OF OIL FROM SHIP DISCHARGE WATER**, Foster-Miller Associates, Inc., Waltham, Mass. A. C. Harvey, and V. K. Stokes.  
In: Prevention and Control of Oil Spills, Proceedings of Joint Conference, Washington, DC, March 13-15, 1973. p. 391-402, 11 fig, 1 tab, 6 ref.

Descriptors: \*Oil spills, \*Oil pollution, \*Water quality control, Water pollution, \*Pollution abatement, Discharge water, Equipment, Tests, Model studies, Prototype tests, \*Separation techniques.  
Identifiers: \*Outer Continental Shelf, Centrifuge, Crude oils, Bilge, Ballast water, Drop size.

A centrifuge was conceived and tested especially for the separation of oil as it is usually dispersed in the bilge and ballast water of ships. The centrifuge is unusual in having predominantly axial flow allowing comparatively high throughput and low speed. It has both primary and secondary stages of separation incorporated into the design and is thus capable of operating with high input concentrations. The device was tested in the laboratory using mixers in a storage tank and a centrifugal pump to disperse up to 8% oil in water. Effluent concentrations in the range of 10 ppm were obtained with inputs containing 1000 ppm of No. 2, No. 4 and Nigerian Crude Oils. At higher concentrations ranging up to 58,800 ppm for No. 2 oil and 18,900 for No. 4 oil the effluent contained less than 100 ppm. Centrifuge performance on No. 2 and No. 4 oils containing 10% Gamlen D was lower than with pure oils. Coalescence occurred but produced drops smaller than with pure oils requiring a modification to the separator design. The input and output oil droplet size distributions were measured using the Coulter particle counter. This permitted an evaluation of separator performance as a function of the drop size content of the oil dispersion and a rational assessment of the design method and its application to the development of future prototypes. (See also W76-09312) (Sinha-OEIS)

W77-00242

**IN-SITU MEASUREMENTS OF OIL BARRIER SHAPE AND LOADS DUE TO CURRENT ACTION**, Rhode Island Univ., Kingston. Dept. of Ocean Engineering.  
G. A. Brown, S. Bartlett, and W. Lamb.  
In: Prevention and Control of Oil Spills, Proceedings of Joint Conference, Washington, DC, March 13-15, 1973. p. 409-419, 8 fig, 4 tab, 12 ref.

Descriptors: \*Oil spills, \*Oil pollution, \*Water quality control, \*Pollution abatement, \*Barriers, Equipment, Environmental effects.  
Identifiers: \*Outer Continental Shelf, Moored barriers, \*Oil barriers, Current action, Wave action, In-situ measurements, Wind effects.

In-situ measurements were made of oil barrier shape and loads created by current action. A commercial cylinder and skirt type barrier with a 100 foot length was used. The barrier was located in Narragansett Bay near the Jamestown Bridge so that the bridge could be used for certain measurements in this experimental program. The barrier shape was obtained by taking transit readings from the Jamestown Bridge on painted target areas located at various spots along the barrier's cylindrical floatation members. The barrier was instrumented with two recording load cells—one at each end of the barrier—and two accelerometers located near the mid-point of the barrier for obtaining vertical and horizontal accelerations. Direct current measurements were made in the vicinity of the barrier by the drifting drogue technique. Wave data were taken with a capacitance wave staff. Local wind speed and direction were noted aboard the accompanying research vessel. The shape, load and current data were used to calculate effective and base coefficients for the barrier. The observed shape was used with several drag coefficient calculations to calculate a predicted drag force on the barrier. The calculated results from these studies are in reasonable agreement with model barrier data taken in laboratory facilities. (See also W76-09312) (Sinha-OEIS)  
W77-00243

**THE ISOLATION AND CHARACTERIZATION OF HYDROCARBON-UTILIZING BACTERIA FROM CHEDABUCTO BAY, NOVA SCOTIA**, Rhode Island Univ., Kingston. Dept. of Plant Pathology-Entomology.  
For primary bibliographic entry see Field 5A.  
W77-00244

**DESIGN PARAMETER STUDY OF AN OIL-SPILL BOOM**, Exxon Production Research Co., Houston, Tex. J. S. Chung, G. R. Cunningham, and J. M. Evon.  
In: Prevention and Control of Oil Spills, Proceedings of Joint Conference, Washington, DC, March 13-15, 1973. p. 427-439, 17 fig, 2 tab, 6 ref, append.

Descriptors: \*Oil spills, \*Oil pollution, \*Water quality control, \*Pollution abatement, Water pollution, Equipment, \*Design.  
Identifiers: \*Outer Continental Shelf, \*Oil booms, Catamaran booms, Containment.

Oil-spill containment boom design involves a broad area of technology: air-oil-water flow in the presence of a moving barrier, wave mechanics, and motions of bodies acted on by winds, waves, and currents. Although many devices have been designed to control oil spills, systematic parametric studies and published engineering design data have been scarce. For this reason, we have studied fundamental design parameters and tested their application to boom design with models in towing tanks and a full-scale sea trial in the Santa Barbara Channel. This work has developed the proper rela-

tionships between the size and shape of boom modules and waves to (1) achieve in-phase motions, (2) determine the optimum net depth for a net-system boom, (3) reduce modular interaction and damage, (4) reduce boom tensions, and (5) determine boom strength requirements. All these are interrelated, but the various parameters are presented by categories. The tests results supporting these parameters are also presented. (See also W76-09312) (Sinha-OEIS)  
W77-00245

**OIL WATER SEPARATION BY ULTRAFILTRATION**, Abcor, Inc., Cambridge, Mass. R. L. Goldsmith, and S. Hossain.  
In: Prevention and Control of Oil Spills, Proceedings of Joint Conference, Washington, DC, March 13-15, 1973. p. 441-456, 20 fig, 5 tab, 4 ref.

Descriptors: \*Oil spills, \*Oil pollution, \*Water quality control, Water pollution, \*Pollution abatement, \*Oily water, \*Oil wastes, Separation techniques, Membranes, Equipment, Membrane processes.  
Identifiers: \*Outer Continental Shelf, \*Ultrafiltration, Ballast water, Bilge, Membrane ultrafiltration, Fuel oils, Crude oil, Ship discharges.

Ultrafiltration with one-inch diameter tubular membranes produced highly-purified water from oil emulsions. For kerosene, No. 6 Fuel oil, Venezuelan crude and lubricating oil at input ratios of 100 ppm to 90 percent, treated water was uniformly free of visible oil and had less than ten ppm oil. Ultrafiltration rate depended on oil type, input ratio and operating conditions. Typically, rates were high, but decreased with time due to membrane fouling. Factors which increased emulsion stability of decreased concentration polarization (e.g. high feed circulation rate) minimized fouling. Membrane cleanup was simple and effective, with no loss in long-term membrane capacity in over 3000 continuous test hours, with cleanup each 72 hours. Cost and physical requirements for systems of 10, 100, 1000, and 10,000 gpm were estimated for membranes in tubular and spiral would configurations. The latter, currently untested, is favored because of lower cost, weight, power, and space requirements. Field trials with actual oily wastes are recommended. (See also W76-09312) (Sinha-OEIS)  
W77-00246

**DROP SIZE DISTRIBUTIONS IN OIL WATER MIXTURES**, Foster-Miller Associates, Inc., Waltham, Mass. V. K. Stokes, and A. C. Harvey.  
In: Prevention and Control of Oil Spills, Proceedings of Joint Conference, Washington, DC, March 13-15, 1973. p. 457-465, 9 fig, 2 tab, 9 ref.

Descriptors: \*Oil spills, \*Oil pollution, \*Water quality control, Water pollution, \*Oily water, \*Separation techniques, Emulsions, Instrumentation, Tests.  
Identifiers: \*Outer Continental Shelf, Centrifuges, Drop size, Settling.

The oil drop size distribution in oil water mixtures is of importance in the design of separators that make use of settling or enhanced settling as in centrifuges. This paper describes an attempt to identify the parameters that affect the size distribution of drops in mechanically generated emulsions. Oil/water mixtures were made by three different methods. On the basis of the results of these tests, a standard procedure for making mixtures was adopted. The results of an extensive series of tests, with three different oils, in which the drop size distributions were measured by a Coulter Counter are presented. (See also W76-09312) (Sinha-OEIS)  
W77-00247

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5G—Water Quality Control

**LARGE-SCALE EXPERIMENTS ON THE SPREADING OF OIL AT SEA AND ITS DISAPPEARANCE BY NATURAL FACTORS.**  
Department of Trade and Industry, Stevenage, (England), Warren Spring Lab.  
P. G. Jeffery.

In: Prevention and Control of Oil Spills, Proceedings of Joint Conference, Washington, DC, March 13-15, 1973. p 469-474, 6 fig, 1 tab, 5 ref.

Descriptors: \*Oil spills, \*Oil pollution, \*Environmental effects, \*Water quality control, Water pollution, Dispersion.  
Identifiers: \*Outer Continental Shelf, \*Oil slicks, Sea state, Oil spreading, Crude oil.

Those considerations that are of importance in undertaking large-scale oil-spreading experiments are described. One such experiment involving a discharge of 120 tons of Iranian Light Crude Oil in the North Atlantic is described, and the spreading pattern observed is reported in detail. The observations continued over a period of four days, after which the bulk of the oil had disappeared by natural factors, leaving only a few patches of thicker oil, largely in the form of a water-in-oil emulsion, which was also rapidly disappearing. Blocker constants have been calculated for the observed spreading of the slick, and these are reasonably constant throughout the four-day period. (See also W76-09312) (Sinha-OEIS)  
W77-00248

**MEASUREMENT OF EVAPORATION RATES FROM OIL SLICKS ON THE OPEN SEA.**  
California Univ., Santa Barbara. Dept. of Chemical and Nuclear Engineering.  
H. O. Sivadier, and P. G. Mikolaj.  
In: Prevention and Control of Oil Spills, Proceedings of Joint Conference, Washington, DC, March 13-15, 1973. p 475-484, 9 fig, 3 tab, 14 ref.

Descriptors: \*Oil spills, \*Oil pollution, \*Environmental effects, \*Water quality control, Water pollution, \*Pollution abatement, Gas chromatography, Evaporation, Seepage, Pollutant identification, Evaporation.  
Identifiers: \*Outer Continental Shelf, Petroleum, Evaporation rate, Oil slicks, Sea surface roughness, Sea state.

A gas chromatographic method of analysis, applicable for all types of petroleum products, has been developed to measure the time dependent extent of evaporation from an oil slick on the open sea. Laboratory calibration tests show the method to have an uncertainty in evaporative weight loss of less than 1 percent. The method has been tested in the Santa Barbara Channel using oil from natural seeps at Coat Oil Point. Under sea state four conditions, this oil lost most of its volatile components in one to two hours. The resulting oil slick residue became sufficiently dense that it could easily enter the water column where it would be subjected to subsurface transport mechanisms. Sea surface roughness was observed to have a significant effect on the rate of evaporation. (See also W76-09312) (Sinha-OEIS)  
W77-00249

**FACTORS GOVERNING THE FATE OF OIL AT SEA; VARIATIONS IN THE AMOUNTS AND TYPES OF DISSOLVED OR DISPERSED MATERIALS DURING THE WEATHERING PROCESS.**  
Exxon Research and Engineering Co., Linden, N.J.  
For primary bibliographic entry see Field 5B.  
W77-00250

**EXPERIMENTAL ECOSYSTEMS TO MEASURE FATE OF OIL SPILLS DISPERSED BY SURFACE ACTIVE PRODUCTS.**  
Institut Francais du Petrole, Rueil-Malmaison (France).  
For primary bibliographic entry see Field 5B.  
W77-00251

**DISTRIBUTION OF HEAVY HYDROCARBONS IN SOME ATLANTIC OCEAN WATERS.**  
Exxon Research and Engineering Co., Linden, N.J.  
For primary bibliographic entry see Field 5B.  
W77-00252

**PREDICTION OF OIL SLICK MOTIONS IN NARRAGANSETT BAY.**  
Rhode Island Univ., Kingston. Dept. of Mechanical Engineering and Applied Mechanics.  
For primary bibliographic entry see Field 5B.  
W77-00253

**CLEANUP OF INLAND OIL SPILLS.**  
Esso Research Centre, Abingdon (England).  
W. E. Betts.  
In: Prevention and Control of Oil Spills, Proceedings of Joint Conference, Washington, DC, March 13-15, 1973. p 549-558, 16 fig, 4 ref, 3 append.

Descriptors: \*Oil spills, \*Oil pollution, \*Water quality control, \*Water pollution, \*Pollution abatement, Groundwater, Inland waterways, Equipment, Rivers, Lakes, Inland waterways.  
Identifiers: \*Cleanup methods, Fuel oil.

The requirements for dealing with accidental inland oil spills is outlined and the importance of using the optimum method of cleanup for each spill and the desirable features for cleanup equipment of efficiency, portability, low cost, ease of use, and versatility is emphasized. New devices are described and have been incorporated into a low-cost package of cleanup equipment. Examples of how a variety of spills have been successfully cleaned up include oil on a fast flowing stream, removal of accumulated oil in a port, oil on a covered drinking water reservoir and oil on rivers. Examples are also given of the method of handling underground pollution by hydraulic drive systems and by recovery from the groundwater for both shallow groundwaters up to 8m below the surface and deep drinking water bore holes. (See also W76-09312) (Sinha-OEIS)  
W77-00254

**TWO TYPES OF OIL SPILLS IN SWEDISH INLAND WATERS—TESTS OF NEW MATERIALS, IDEAS AND METHODS.**  
Swedish State Railways, Stockholm.  
A. Jerbo.  
In: Prevention and Control of Oil Spills, Proceedings of Joint Conference, Washington, DC, March 13-15, 1973. p 559-567, 12 fig, 5 tab.

Descriptors: \*Oil spills, \*Oil pollution, \*Water quality control, \*Water pollution, \*Pollution abatement, Equipment, Inland waterways, Sediments, Rivers.  
Identifiers: Oil booms, \*Sweden.

In February 1972, 600 tons of diesel oil was spilled in a river in the northern part of Sweden. Downstream from the spill is a system of hydroelectric power stations, fisheries and freshwater-intakes. The restoration was divided into using standard methods and developing new methods and materials. Thus: a pontoon bridge was built across the river; from the bridge adsorption material, Saneringsull, was blown out over the floating oil; oil-contaminated ice and snow was burned together with Saneringsull; the adsorbed oil was allowed to be frozen in the ice; the ice containing oil and adsorption materials was lifted to an

ice-tip, later on the ice was melted; oil on free water surface was adsorbed. The adsorption material was spread from aircraft and boats; later on the adsorption material was transported to the shore and burned in incinerators; in order to protect the downstream area three types of booms were designed, no conventional boom could ever be used; every week water-samples were taken and analysed; and testfishing was performed in May 1972. The amount of oil one mile downstream from the last boom was never higher than 1 PPM and the fish did not contain any phenols or oils. The oil content of the surface water in the spill area and 5 miles downstream was, after the clean up job, at about 3 PPM which is normal for river during the timber-floating period. (See also W76-09312) (Sinha-OEIS)  
W77-00255

**TROPICAL STORM AGNES PENNSYLVANIA'S TORREY CANYON.**  
Environmental Protection Agency, Washington, D. C.  
R. Kaiser, D. Jones, and H. Lamp'l.  
In: Prevention and Control of Oil Spills, Proceedings of Joint Conference, Washington, DC, March 13-15, 1973. p 569-577, 7 fig.

Descriptors: \*Oil spills, \*Oil pollution, \*Water quality control, \*Inland waterways, Water pollution, \*Hurricanes, \*Storms, \*Pennsylvania, Equipment, Cleaning, Materials.  
Identifiers: \*Tropical Storm Agnes.

The 'Agnes Story' disaster as related to the largest inland oil spill experienced in the history of the U.S. and actions taken by EPA in coping with the problem are presented. The inland rivers of the Middle Atlantic area experienced spills of petroleum products ranging from over 3,000,000 gallons of No. 2 fuel oil, gasoline and kerosene from storage tanks in Big Flats/Elmira, N.Y. (just north of the Pennsylvania border) to 6,000,000-8,000,000 gallons of black, highly metallic waste oil and sludge from an oil reclamation plant on the Schuylkill River. The aftermath of this gigantic inland spill was oil and gasoline soaked fields, oil coated trees, farm houses, homes, factories, an airport, and hundreds of stranded oil puddles, ponds and lagoons as the rivers receded to normal levels. Major spill effects and significant cleanup operations, problems encountered, and lessons learned are presented so that future responses can be better and more efficiently dealt with in an inland oil spill disaster comparable to the 'Agnes Oil Spill'. (See also W76-09312) (Sinha-OEIS)  
W77-00256

**LAKE CHAMPLAIN: A CASE HISTORY ON THE CLEANUP OF NO. 6 FUEL THROUGH FIVE FEET OF SOLID ICE AT NEAR-ZERO TEMPERATURES.**  
Environmental Protection Agency, Edison, N. J. Region II.  
H. Lamp'l.  
In: Prevention and Control of Oil Spills, Proceedings of Joint Conference, Washington, DC, March 13-15, 1973. p 579-582, 5 fig.

Descriptors: \*Oil spills, \*Oil pollution, \*Water quality control, \*Pollution abatement, \*Ice, Lakes, Cleaning, Materials, Equipment, Treatment.  
Identifiers: \*Lake Champlain, Fuel oil, Solid ice.

The removal of 44,000 gallons of No. 6 fuel from Lake Champlain in March, 1971, while the lake was frozen to a depth of five feet in the area affected by the spill is reported. The circumstances of the spill, the location and the adverse weather conditions presented a unique challenge to on scene personnel in their quest to remove thick, viscous oil from a frozen, high-amenity lake. When confronted with this major spill (as classified by the National Contingency Plan) the on scene personnel had no precedence upon which to



base their plan of attack. Improvisation was the keynote of the whole operation during the 'life' of this spill. Many novel ideas and techniques were utilized, not only to remove the oil, but to contain it from further pollution the waters of Lake Champlain. (See also W76-09312) (Sinha-OEIS) W77-00257

#### SUCCESSSES AND FAILURES WITH OIL SPILLS IN THE SOUTHEASTERN INLAND WATERS,

Environmental Protection Agency, Atlanta, Ga. Environmental Emergencies Branch.

A. J. Smith.  
In: Prevention and Control of Oil Spills, Proceedings of Joint Conference, Washington, DC, March 13-15, 1973. p 583-588, 4 fig, 5 ref.

Descriptors: \*Oil spills, \*Oil pollution, \*Water quality control, Water pollution, \*Inland waterways, \*Pollution abatement, \*Environmental effects, Water treatment, Southeast U.S. Identifiers: Cleanup methods, Containment.

A brief review of several spill cases that have occurred in the Southeast in the recent past are presented. Each case describes a unique situation—either in terms of containment, retention or removal methodology. At Athens, Georgia, a pipeline break caused the closure of the Athens Water Supply System for twenty-four hours. A pipeline break near Shepherdsville, Kentucky, forced some 16,000 gallons of crude oil into a subsurface layer of gravel. Interception trenches were used to tap the gravel layers and water was forced into the layer up the gradient in order to 'flush' the system. A vandalized storage tank adjacent to the Congaree River was emptied of 10,000 Bunker 'C' near Columbia, South Carolina. Elaborate containment and recovery procedures were employed downstream. The oil, however, disappeared—save for minor vegetation stain, and non reached the recovery site. River velocity, wind speed, temperature of the water and turbidity are discussed as contributors to this phenomena. At Jackson, Mississippi, a broken sludge pond dyke at a drilling operating dumped 40,000 gallons of 'oil slaps' and brine into the Big Black River. Retention on the surface was impossible because of the eight to ten knot river velocity. Light disposable sorbing booms were used to recover an estimated 80% of the oil. Pictures and sketches are utilized to emphasize technical aspects of each situation. (See also W76-09312) (Sinha-OEIS) W77-00258

#### AN EFFECTIVE OIL SPILL CONTAINMENT-RECOVERY SYSTEM FOR HIGH SEAS USE,

Exxon Co. U.S.A., Los Angeles, Calif. J. L. Glaeser.

In: Prevention and Control of Oil Spills, Proceedings of Joint Conference, Washington, DC, March 13-15, 1973. p 589-596, 10 fig.

Descriptors: \*Oil spills, \*Oil pollution, \*Water quality control, Water pollution, \*Pollution abatement, \*Environmental effects, Oceans, Equipment, Materials, Tests, Weirs, Skimming, Resources, Weather  
Identifiers: \*Outer Continental Shelf, Oil booms, Oil skimmers, Containment, \*Oil recovery.

The development and testing of a new operational oil spill containment-recovery system is discussed. Unique designs incorporated into the system include: (1) an oil spill containment barrier utilizing a 'Bottom Tension' concept to increase containment effectiveness and survival strength; and (2) a wave compensating, weir type skimmer system utilizing a droplet formation process to recovery high viscosity emulsions. A testing program has described the operational characteristics of the system. The results of this program are presented. A typical operational 'package' using the basic boom and skimmer components is discussed. (See also W76-09312) (Sinha-OEIS) W77-00259

#### CASE STUDIES OF THE USN SUPERVISOR OF SALVAGE, SALVAGE RELATED OIL POLLUTION INCIDENTS,

Naval Ship Systems Command, Washington, D. C. Office of the Director of Ocean Engineering. D. E. Irons.

In: Prevention and Control of Oil Spills, Proceedings of Joint Conference, Washington, DC, March 13-15, 1973. p 597-600, 3 fig.

Descriptors: \*Oil spills, \*Oil pollution, \*Water quality control, \*Pollution abatement, Water pollution, Discharge(Water), Personnel training, Rivers, Harbors, Beaches, Islands.  
Identifiers: \*Outer Continental Shelf, Groundings, Collisions, Salvage.

The involvement of the U.S. Navy salvage forces in oil pollution control, prevention and cleanup of spills generated by ships damaged by fire, groundings, collisions and overboard discharge is described. The six cases discussed include oil pollution threats to a major river, a major harbor, a turtle sanctuary on an isolated western Pacific Island and the open ocean and the adjoining miles of beaches. Methods and equipments used to combat the spills are described in detail. The Navy salvage forces including world-wide pools and bases of back-up equipment are discussed. Training of Naval personnel in oil pollution abatement techniques and the use of the many and varied equipments and materials is described. The status of on-going research and development programs which provide improved methods and equipment to combat oil pollution is reported. (See also W76-09312) (Sinha-OEIS) W77-00260

#### JET OIL RECOVERY DEVICE,

Griffiths (James) and Sons, Inc., Seattle, Wash.

J. K. Stewart.

In: Prevention and Control of Oil Spills, Proceedings of Joint Conference, Washington, DC, March 13-15, 1973. p 601-615, 23 fig.

Descriptors: \*Oil spills, \*Oil pollution, \*Water quality control, Water pollution, \*Pollution abatement, \*Separation techniques, Treatment, Equipment, Prototype tests, Tests, Surface tension, Jets.  
Identifiers: \*Outer Continental Shelf, Deepsea, \*Jet oil recovery.

The jet oil recovery device described causes contact of jet water streams with the recovered oil and separates the fluids within it. This concept involves the utilization of the surface tension characteristic of oil along with the hydraulic jet action to lift floating oil over a non-adjustable weir. A low pressure stream of water will carry with it an almost equal volume of contacted oil, depending on the type of oil, depth, jet angularity and outlet submersion, and other variable criteria. This paper is descriptive and findings reflect actual physical construction and tests only. (See also W76-09312) (Sinha-OEIS) W77-00261

#### CODES OF PRACTICE FOR DEALING WITH OIL SPILLS AT SEA AND ON SHORE: A EUROPEAN VIEW

Institute of Petroleum, London (England).

L. R. Beynon.

In: Prevention and Control of Oil Spills, Proceedings of Joint Conference, Washington, DC, March 13-15, 1973. p 617-626, 10 tab.

Descriptors: \*Oil spills, \*Oil pollution, \*Water quality control, Water pollution, \*Pollution abatement, \*Estuaries, Shores, Beaches, Absorption, Burning, Dispersion.  
Identifiers: \*Outer Continental Shelf, Crude oils, Fuel oil, Distillate fuels, Waxy oils, Bunker oil, Oil booms, Sinking, Pick-up.

Representatives of nine countries of Western Europe have been preparing codes of practice for dealing with oil spills at sea and those which have reached the shore. This paper describes the codes which have been produced. The codes set out the recommended methods, in order of priority, for six main 'location variables.' (1) Open or rough sea; (2) Open sea, close to shore; (3) Estuaries; (4) Sheltered, calm waters (including ports and harbors); (5) On shore; and (6) Ice conditions. The other main variables taken into account are type and quantity of oil spill. 'Oil type' has been subdivided into: (a) Crude oils which spread on contact with water; (b) Crude oils which have weathered on the sea; (c) Water-in-oil-emulsions; (d) Heavy fuel oils; (e) Distillate fuels; and (f) Waxy oils which tend to coagulate into lumps on contact with the sea. (See also W76-09312) (Sinha-OEIS) W77-00262

#### QUANTITATIVE EVALUATION OF MECHANICAL OIL SPILL CLEANUP DEVICES,

Civil Engineering Lab. (Navy), Port Hueneme, Calif.

J. J. Der, and D. J. Graham.

In: Prevention and Control of Oil Spills, Proceedings of Joint Conference, Washington, DC, March 13-15, 1973. p 627-633, 3 fig, 5 tab, 3 ref.

Descriptors: \*Oil spills, \*Oil pollution, \*Water quality control, Water pollution, \*Pollution abatement, Equipment, Tests, Cleaning, Weirs.  
Identifiers: \*Outer Continental Shelf, Oleophilic disks, Oleophilic belts, Saucer weir, Sorbents, Vortex weirs.

A systematic quantitative method has been developed which can be used for preliminary screening and with the availability of more accurate performance data, used for final evaluation and selection of candidate oil removal devices. This method has been applied to various types of devices available commercially. Although the lack of precision in available performance data precludes selection between devices with close rating, an outstanding score of a device under the present method is an indication of its potential for further study or development. The result shows that for confined area operation inverted belts and a saucer weir with hydro-adjusting feature have high potential. A system based on the mechanized recovery of polyurethane foam rated high for the open area operation. The effectiveness indices for all of the open area devices considered fall in a narrow range, however, and final selection must be based on more accurate data from field and wave tank tests. (See also W76-09312) (Sinha-OEIS) W77-00263

#### OIL/SORBENT HARVESTING SYSTEMS FOR USE ON VESSELS OF OPPORTUNITY,

Woodard-Clyde Consultants, San Francisco, Calif. Envision Div.

J. D. Sartor, and C. Foget.

In: Prevention and Control of Oil Spills, Proceedings of Joint Conference, Washington, DC, March 13-15, 1973. p 635-641, 9 fig, 3 tab.

Descriptors: \*Oil spills, \*Oil pollution, \*Water quality control, Water pollution, \*Pollution abatement, Harvesting, Oceans, California, Equipment, Material, Tests.  
Identifiers: \*Outer Continental Shelf, Vessels of opportunity, Sorbents, Wire mesh belts, Straw.

A system for harvesting mixtures of oil and sorbent materials, primarily straw, which could be utilized for the recovery of floating oil from water was developed for use on vessels of opportunity. The first phase of the program involved testing individual system components and operating parameters as to their effectiveness in picking up sorbents only under actual conditions in a salt-water slough. The second phase entailed evaluat-

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ing those operating characteristics of the harvesting system components selected in the first phase using crude oil and various sorbents in a test tank. The test program entailed the installation of the complete system on a vessel of opportunity (an LCM), and demonstration of the ability of the system to operate under actual conditions. The system was evaluated both in the San Francisco Bay and off Coal Oil Point, Santa Barbara where sorbent materials were dispensed over natural oil slicks. The system was found to be very effective in recovering sorbents (straw and polyurethane foam) from the water surface. (See also W76-9312) W77-00264

**USE OF THE MASSACHUSETTS DIP OIL SKIMMER ON FREE SLICKS IN THE CASCO BAY (PORTLAND) SPILL,** JBF Scientific Corp., Burlington, Mass. R. A. Bianchi, E. E. Johanson, and J. H. Farrell. In: Prevention and Control of Oil Spills, Proceedings of Joint Conference, Washington, DC, March 13-15, 1973. p 643-655, 19 fig.

Descriptors: \*Oil spills, \*Oil pollution, Water pollution, \*Water quality control, Pollution abatement, \*Skimming, Cleaning, Harvesting, Beaches, Massachusetts.  
Identifiers: Oil slicks, \*Casco Bay(MA), Fuel oil, \*Oil skimmers, Oil booms, Straw, Debris.

On July 22, 1972, the tanker Tamano, carrying a full load of No 6 fuel oil, sustained a ruptured tank and reportedly spilled on the order of 100,000 gallons of oil in Casco Bay. For two weeks following the accident, the Tamano was anchored and surrounded by containment booms while its cargo was off-loaded and cleanup operations were performed. This paper describes the role newly developed Dynamic Inclined Plane (DIP) Skimmer played in the cleanup operation and presents observations and evidence of the need for, and effectiveness of, a mobile skimmer in large spill situations. The role of support vessels in maintaining the skimming operation and handling the collected liquids and solids is examined. The effective use of skimmers is demonstrated over a wide range of environmental conditions and the full range of oil debris conditions from the newly spilled, relatively clean oil to the weathered straw-seaweed-debris-laden material that exists after several days. The oil skimmer was secured to the side of several different vessels and used in a sweeping mode to collect heavy weathered No. 6 oil, oily straw, oily seaweed, and debris. Several conditions are presented including harvesting of windrows of oil and debris, harvesting thick oil in a free slick (in seas several feet high), and harvesting both thick oil and sheen leaking from a boom. The effectiveness of these operations is explored in terms of both pickup and transfer. (See also W76-09312) (Sinha-OEIS) W77-00265

**DEVELOPMENT OF METHODOLOGY AND APPARATUS FOR THE BIOASSAY OF OIL,** Battelle-Pacific Northwest Labs., Richland, Wash.  
For primary bibliographic entry see Field 5A. W77-00266

**A REINVESTIGATION OF SOUTHERN CALIFORNIA ROCKY INTERTIDAL BEACHES THREE AND ONE-HALF YEARS AFTER THE 1969 SANTA BARBARA OIL SPILL: A PRELIMINARY REPORT,** University of Southern California, Los Angeles. Allan Hancock Foundation.  
For primary bibliographic entry see Field 5C. W77-00267

**THE RESPONSE OF MACROINVERTEBRATES TO GASOLINE POLLUTION IN A MOUNTAIN STREAM,** Environmental Protection Agency, Kansas City, Mo. Surveillance and Analysis Div.  
For primary bibliographic entry see Field 5C. W77-00268

**TERRESTRIAL OIL SPILLS IN ALASKA: ENVIRONMENTAL EFFECTS AND RECOVERY,** Army Engineer Waterways Experiment Station, Vicksburg, Miss.  
For primary bibliographic entry see Field 5C. W77-00269

**A STUDY OF THE EFFECTS OF THE SAN FRANCISCO OIL SPILL ON MARINE ORGANISMS,** College of Marin, Kentfield, Calif.  
For primary bibliographic entry see Field 5C. W77-00270

**INTERAGENCY INVESTIGATIONS OF A PERSISTENT OIL SPILL ON THE WASHINGTON COAST,** National Marine Fisheries Service, Seattle, Wash.  
For primary bibliographic entry see Field 5C. W77-00271

**THE PHYSICAL OCEANOGRAPHY AND WATER QUALITY OF NEW YORK HARBOR AND WESTERN LONG ISLAND SOUND,** State Univ. of New York at Stony Brook. Marine Sciences Research Center. D. A. Jay, and M. J. Bowman.  
Technical Report No. 23, Reference No. 75-7, December 1975. 75 p, 21 fig, 9 tab, 110 ref, 3 append.

Descriptors: \*Oceanography, \*Water quality, \*Sewage effluents, New York, \*Water pollution sources, \*Estuarine environment, \*Transport, Salinity, Pollutants, Nutrients, Water resources, Circulation, Path of pollutants.  
Identifiers: \*New York Harbor, \*Long Island Sound, New York Bight, Physical oceanography.

The literature on the tides, currents, hydrography and hydrology of New York Harbor from 1843 to date is reviewed. Particular emphasis is placed on the relationship between water, salt and pollutant transport mechanisms in the East River, the Harbor and western Long Island Sound. An estuarine circulation in the Upper East River modifies the hydraulic regime and transports Upper East River surface water toward Long Island Sound. The observed distributions of nutrients and sewage effluents suggest that the estuarine and dispersive mechanisms in the East River transport a considerable fraction of sewage emptied into the East River to the Sound, while the advective component is expected to transport effluents into New York Harbor. Transport of sewage pollutants from the East River is probably a major factor causing the observed violations of state and federal water quality standards in western Long Island Sound. It is concluded that the East River, particularly the upper section, is a very poor location to release sewage effluents. (NOAA) W77-00273

**COASTAL ZONE BIBLIOGRAPHY: CITATIONS TO DOCUMENTS ON PLANNING, RESOURCES MANAGEMENT AND IMPACT ASSESSMENT, SECOND EDITION,** California Univ., San Diego, La Jolla. Inst. of Marine Resources.  
For primary bibliographic entry see Field 2L. W77-00277

**ECONOMIC IMPACTS OF STATE ENVIRONMENTAL PROGRAMS IN A NATIONAL**

**FRAMEWORK: THE IOWA CONSERVANCY LAW,** Iowa State Univ., Ames. Center for Agricultural and Rural Development.  
For primary bibliographic entry see Field 6G. W77-00303

**EFFECT OF PLOUGHING AND DIRECT DRILLING ON SOIL NITRATE CONTENT,** Agricultural Research Council, Wantage (England). Letcombe Lab.  
For primary bibliographic entry see Field 2G. W77-00305

**SHORT TERM NITRATE LOSSES AND ASSOCIATED MICROBIAL POPULATIONS IN SOIL COLUMNS,** California Univ., Berkeley. Dept. of Soils and Plant Nutrition.  
For primary bibliographic entry see Field 2G. W77-00309

**SOIL ORGANIC MATTER FRACTIONS AS SOURCES OF PLANT AVAILABLE SULPHUR,** Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Plant Industry.  
For primary bibliographic entry see Field 2G. W77-00310

**A SYSTEMATIC PROCEDURE FOR TAXING AGRICULTURAL POLLUTION SOURCES,** Colorado State Univ., Fort Collins. Dept. of Agricultural Engineering. W. R. Walker.  
Engineering Mechanics Section, Civil and Environmental Technology Program, National Science Foundation, Washington D.C. 20550. October 1975, 98 p, 12 tab, 22 fig, 33 ref.

Descriptors: \*Model studies, Agriculture, \*Pollution charges(Taxes), \*Colorado River Basin, \*Taxes, Tax rates, \*Salinity, \*Methodology, Water quality control, Water pollution sources.  
Identifiers: \*Diffuse agricultural pollution, Grand Valley(Colo).

A methodology for taxing diffuse agricultural pollution sources is presented which is based upon deriving linkages between three economic and hydrologic modeling systems. The procedure involves modeling the hydro-quality system in the agricultural area in order to identify the specific processes causing water quality degradation. Then, these results are linked through a pollution coefficient to an economic externalities model describing the detriments incurred by downstream uses of water with poor quality characteristics. And finally, an input-output model is developed from which input coefficients and business multipliers are calculated as a means of assessing the local economic impact of alternative taxing policies. The Grand Valley in Western Colorado is taken as the case study for this project since it is one of the more significant sources of salinity in the Colorado River Basin. The analysis evaluates the potential for taxing agricultural croplands in the valley as a means of controlling salinity related damages in the lower Colorado River Basin. Four groups of taxing strategies are investigated: (1) directly attributable detriments, (2) per acre equivalent salt loading, (3) salinity or pollution coefficients, and (4) values of gross revenue per acre. A discussion of how each tax could be applied is presented. (Skogerboe-Colo St) W77-00314

**ANNOTATED BIBLIOGRAPHY ON TRICKLE IRRIGATION,** Colorado State Univ., Fort Collins. Dept. of Agricultural Engineering.  
For primary bibliographic entry see Field 3F. W77-00315

**STATUS REPORT ON ABATEMENT OF EFFLUENTS FROM THE CANADIAN PULP AND PAPER INDUSTRY -- 1974.**

Environmental Protection Service, Ottawa (Ontario).

Economic and Technical Review Report No. EPS 3-WP-75-6, December, 1975. 33 p, 3 fig, 11 tab.

Descriptors: \*Pollution abatement, \*Pulp and paper industry, \*Canada, Water pollution control, Water pollution sources, Legislation, Investment, Treatment facilities, Economics, Biological treatment, Energy, Costs, Sulfite liquors, Effluents, \*Pulp wastes, Water quality standards, Regulation.

Identifiers: Chemical recovery, Thermomechanical pulping, Sulfite pulp mills, Newsprint mills.

Regulations to limit the discharge of pollutants from Canada's pulp and paper mills were promulgated in November, 1971. During 1969-1974, significant reductions in such discharges were achieved, even with the increased production. The majority of mills are presently covered by compliance programs, but further work must be done before the minimum limits prescribed in the pulp and paper effluent regulations are achieved. Mills are encouraged to practice prevention rather than treatment. In the period 1969-1974, industry expenditures for abatement facilities amounted to \$300,000,000. An additional \$811,000,000 will be required to achieve compliance in all mills. Effluent abatement at integrated newsprint/sulfite mills poses the most difficult problem. The installation of abatement facilities, such as waste liquor recovery furnaces and incinerators, may not be economically feasible because of high capital costs. Alternative abatement measures, such as biological treatment, could involve high costs, as well as increased energy requirements. One potential solution may involve consolidation of several small mills into a larger operation, making liquor recovery economically more attractive. Process changes, such as a switch to thermomechanical pulping, may be another solution. (Witt-IPC)  
W77-00331

**EROSION AND RUNOFF ON FOREST AND RANGE LANDS.**

Forest Service (USDA), Ogden, Utah. Intermountain Forest and Range Experiment Station.  
For primary bibliographic entry see Field 4C.

W77-00332

**MICROORGANISMS AS INDICATORS OF THE ENVIRONMENTAL HYGIENE: ECOLOGY, TAXONOMY AND ENUMERATION, (IN DUTCH).**

Ghent Rijksuniversiteit (Belgium). Inter-Faculty Centre for Environmental Sanitation.  
For primary bibliographic entry see Field 5A.

W77-00348

**HYGIENIC PROBLEMS OF ENVIRONMENTAL PROTECTION IN CONNECTION WITH THE FURTHER DEVELOPMENT OF SIBERIA AND THE FAR EAST, (IN RUSSIAN).**

A. P. Shitskova.  
Gig Sanit 4, p 12-15, 1975.

Descriptors: Asia, \*Public health, \*Environmental sanitation, Natural resources, Water pollution, Air pollution, Water quality standards, \*Environment.  
Identifiers: Far-East, \*Siberia, \*USSR.

In connection with the development of the natural resources and buildup of the industrial potential of Siberia, the Far East and the Far North of the USSR, environmental protection is discussed as a broad social hygienic problem encompassing improvement of working and living conditions, protection of water resources, air, soil, and food products, noise control and other sanitary factors. -Copyright 1976, Biological Abstracts, Inc.  
W77-00349

**BIBLIOGRAPHY ON TIDAL HYDRAULICS, SUPPLEMENTARY MATERIAL COMPILED FROM MAY 1971 TO MAY 1974, ES 816, TIDAL FLOWS IN RIVERS AND HARBORS.**

Committee on Tidal Hydraulics (Army), Washington, D.C.

For primary bibliographic entry see Field 2L.  
W77-00353

**SEABED DRIFTER MOVEMENT IN SAN DIEGO BAY AND ADJACENT WATERS.**

Naval Undersea Center, San Diego, Calif.  
For primary bibliographic entry see Field 5B.

W77-00356

**A BALANCED REGIONAL INPUT-OUTPUT MODEL FOR IDENTIFYING RESPONSIBILITY FOR POLLUTION CREATED BY INDUSTRIES WHICH SERVE NATIONAL MARKETS.**

State Univ. of New York at Binghamton. School of Management.

M. Chatterji.

International Regional Science Review, Vol. 1,

No. 1, p. 87-94, 1975. 7 ref.

Descriptors: \*Pollutant identification, \*Input-output analysis, \*Cost allocation, Cost transfer, Mathematical models, Spatial distribution, Regional economies, Pollution abatement, Environment, Management.

A balanced input-output model is designed to identify regional responsibility for pollution generation and control based on classification of production of useful goods as either local, regional, or national. Eleven equations produce a regional and national linkage of the output of the regional goods in the region with national final demand, the final demand of the region for regional goods, and the tolerable level of pollution final demand. If there is some change in any of the above exogenous factors, then the change in the output of the regional goods in the region can be calculated. The last two equations can be used for policy decisions, e.g., suppose a power plant must be constructed in a specific region. Then the responsibility for the pollution associated with its operations can be assigned relative to the two exogenous factors—national final demand, and final demand in the region, but only after adjustment is made for the acceptable level of pollution in the specified region. Similarly, the responsibility for the pollution from journey-to-work transportation and other regional activities can be related to the demand of that region and of all others. This analysis can be extended to pricing and value added by production. (Auen-Wisconsin).  
W77-00382

**THE INTEGRATION OF ENVIRONMENTAL AND DEVELOPMENT PLANNING FOR ECOLOGICAL CRISIS AREAS IN AFRICA.**

Nairobi Univ. (Kenya). Dept. of Geography.

For primary bibliographic entry see Field 6G.

W77-00385

**ENVIRONMENTAL FACTORS IN PRODUCING SUPPLEMENTAL FUELS.**

For primary bibliographic entry see Field 6G.

W77-00390

**EFFLUENT CHARGES AND POLITICAL REALITIES—A QUALIFICATION.**

Pennsylvania State Univ., University Park. Dept. of Economics.  
T. A. Ferrar, P. G. Sassone, and A. B. Brownstein.

Journal of Environmental Systems, Vol. 5, No. 2,

p 95-101, 1975. 5 ref.

Descriptors: \*Pollution taxes (Charges), \*Efficiencies, \*Equity, Economic impact, New York, \*Political aspects, Legal aspects, Taxes, Legislation, Regulation.  
Identifiers: \*New York (NY).

The efficacy of pollution taxes as a pollution abatement tool is assessed, specifically in its application to New York City during the 1972 winter when it was faced with a shortage of low-sulfur content residual fuel oil. In order to minimize damage to the ambient environment yet avoid potential welfare loss, a general variance to the sulfur-content regulations was granted jointly with a surcharge. The implications of that approach are examined with the conclusion that the existence of a legally specified 'fairness principle' effectively prohibited the construction of an optimal effluent charge. It is also pointed out that a 'fairness' stipulation is the central feature of the Pure Air Tax Act of 1972. The economic character of the New York City effluent charge system is analyzed by a model and demonstrates that ethically satisfying restrictions effectively thwart efficiency properties of effluent charges since the marginal damage function depends on a variety of meteorological, topological, demographic, and other socioeconomic factors; thus the optimum user charge must vary within a given environmental management region in order to achieve the efficiency characteristics. The central point is that the restrictions mandated by the political-legal setting in New York City and the federal legislation refused to recognize these differences and hence fail in optimal resource allocation. (Auen-Wisconsin).  
W77-00392

**BASF COMPLETES TEN-YEAR PROJECT FOR CLEANING UP THE RHINE.**

For primary bibliographic entry see Field 5D.

W77-00403

**INTRODUCTION TO THE KNOWLEDGE OF FRESHWATER INVERTEBRATES AND THEIR ENVIRONMENT, (IN DUTCH).**

Rijksinstituut voor Natuurbeheer, Leersun (Netherlands).

For primary bibliographic entry see Field 2L.

W77-00410

**ROLE OF THE MUSSEL IN PURIFYING SEA WATER OF PETROLEUM PRODUCTS (IN EXPERIMENT), (IN RUSSIAN).**

Polyarnyi Nauchno-Issledovatel'skii i Proektnyi Institut Morskogo Rybnogo Khozyaistva i Okeanografii, Murmansk (USSR).  
E. V. Bioko, and Yu. M. Petrov.  
Gidrobiol Zh. 11(2), p 28-33, 1975.

Descriptors: \*Mussels, \*Water purification, \*Sea water, \*Oil pollution, Oil spills, Oil wastes, Organic compounds.  
Identifiers: \*Mytilus-Edulis.

The influence of *Mytilus edulis* on purification of seawater of petroleum products was studied under experimental conditions and quantitative indices determined. In aquariums with *M. edulis*, water is purified twice as fast as in the control (without animals). About 7% of the initial amount of petroleum product remains in the aquariums 3 wk after *M. edulis* is put into it; 1.4% of these products is settled by hydrobionts onto the bottom of the vessels, 5.6% remains in the surface film and about 0.2% is dissolved in the water. An assumption is made that chemical oxidation of oil starts 3 wk after its introduction. -Copyright 1976, Biological Abstracts, Inc.  
W77-00418

**THE VIEW OF THE PAPER INDUSTRY ON THE OCCURRENCE OF PCB'S IN THE ENVIRONMENT AND THE NEED FOR REGULATION.**

Container Corp. of America, Carol Stream, Ill.

For primary bibliographic entry see Field 5B.

W77-00461



## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5G—Water Quality Control

**STATEMENT RELATING TO POLYCHLORINATED BIPHENYLS ON BEHALF OF THE WISCONSIN PAPER COUNCIL,** Bergstrom Paper Co., Neenah, Wis.  
For primary bibliographic entry see Field 5B.  
W77-00462

**EROSION IN 1973-74: THE RECORD AND THE CHALLENGE,** Soil Conservation Service, Washington, D. C.  
For primary bibliographic entry see Field 2J.  
W77-00471

**EPA AND AGRICULTURE: ESTABLISHING A PARTNERSHIP,** Environmental Protection Agency, Washington, D. C.  
R. E. Train.  
Journal of Soil and Water Conservation, Vol. 30, No. 1, p 33-35, January-February, 1975.

**Descriptors:** \*Agriculture, \*Environmental control, \*Environment, Pollution, Water quality, Ecology, Environmental effects, Pollution abatement.  
**Identifiers:** \*Environmental protection agency.

Pollutants often cross natural barriers or otherwise interact to exercise profound effects on the world environment. On the other hand, corrective action taken in one place may produce benefits in others as well. Fortunately, water pollution control and soil and water conservation require identical measures in most instances. The control of soil erosion, for example, though it cannot prevent the loss of some soluble compounds, does keep waterways free of sediments with their attached, insoluble pesticides and nutrients. And pollution control itself is a vital part of any water conservation project. (Skogerboe-Colo St)  
W77-00472

**INTERACTIONS BETWEEN ORGANIC COMPOUNDS, MINERALS, AND IONS IN VOLCANIC ASH DERIVED SOILS: I. ADSORPTION OF BENZOATE, P-OH BENZOATE, SALICYLATE, AND PHTHALATE IONS,** California Univ., Riverside. Dept. of Soil Science.  
For primary bibliographic entry see Field 2G.  
W77-00473

**INTERACTIONS BETWEEN ORGANIC COMPOUNDS, MINERALS, AND IONS IN VOLCANIC-ASH-DERIVED SOILS: II. EFFECTS OF ORGANIC COMPOUNDS ON THE ADSORPTION OF PHOSPHATE,** California Univ., Riverside. Dept. of Soil Science.  
For primary bibliographic entry see Field 2G.  
W77-00474

**EFFECT OF AGRICULTURAL DRAINAGE ON WATER QUALITY,** Virginia Polytechnic Inst. and State Univ., Blacksburg. Southern Piedmont Center.  
For primary bibliographic entry see Field 5B.  
W77-00475

**IOWA'S EXPERIENCE WITH A MANDATORY SEDIMENT CONTROL LAW,** Iowa Dept. of Soil Conservation, Des Moines.  
For primary bibliographic entry see Field 6E.  
W77-00477

**NITRATE REDUCTION AND NITRITE UTILIZATION BY NITRIFIERS IN AN UNSATURATED HANFORD SANDY LOAM,** California Univ., Berkeley. Dept. of Soils and Plant Nutrition.  
For primary bibliographic entry see Field 5B.  
W77-00478

## 6. WATER RESOURCES PLANNING

### 6A. Techniques Of Planning

**THE USE OF CONTINUOUS SIMULATION IN THE EVALUATION OF WATER QUALITY MANAGEMENT PLANS,** Hydrocomp, Inc., Palo Alto, Calif.  
For primary bibliographic entry see Field 5G.  
W77-00001

**APPLICATION OF A HYDROLOGIC MODEL TO THE PLANNING AND DESIGN OF STORM DRAINAGE SYSTEMS FOR URBAN AREAS,** Utah Water Research Lab., Logan.  
For primary bibliographic entry see Field 4A.  
W77-00004

**OPTIMAL DESIGN OF SINGLE RESERVOIR SYSTEM USING (DELTA) RELEASE POLICY,** California Polytechnic State Univ., San Luis Obispo. Dept. of Computer Science and Statistics.  
For primary bibliographic entry see Field 4A.  
W77-00109

**A RELIABILITY ASSESSMENT FOR REGIONAL WATER QUALITY MANAGEMENT,** Texas Univ., San Antonio. Div. of Environmental Studies.  
For primary bibliographic entry see Field 5G.  
W77-00114

**OR DATA BASE INTERFACE--AN APPLICATION TO POLLUTION CONTROL,** Carnegie-Mellon Univ., Pittsburgh, Pa.  
For primary bibliographic entry see Field 5G.  
W77-00116

**ECONOMIC OPTIMUM RECORD LENGTH,** Nielsen and Rauschenberger A/S, Lyngby (Denmark).  
For primary bibliographic entry see Field 4A.  
W77-00117

**ENVIRONMENT, ENERGY, AND CAPITAL IN THE FOSSIL FUELED ELECTRIC POWER INDUSTRY,** Houston Univ., Tex.  
For primary bibliographic entry see Field 3E.  
W77-00118

**A COMPUTERIZED SYSTEM FOR WILD LAND USE PLANNING AND ENVIRONMENTAL IMPACT ASSESSMENT,** Washington Univ., Seattle. Coll. of Forest Resources.  
For primary bibliographic entry see Field 6G.  
W77-00119

**OPTIMIZATION OF STATE WATER QUALITY MONITORING SYSTEMS,** Environmental Research Lab., Corvallis. Oreg.  
For primary bibliographic entry see Field 5G.  
W77-00120

**THE USE OF STOCHASTIC MODELS IN THE INTERPRETATION OF HISTORICAL DATA FROM SEWAGE TREATMENT PLANTS,** Wisconsin Univ., Madison.  
For primary bibliographic entry see Field 5D.  
W77-00121

**WEATHER-DEPENDENT PRICING FOR WATER RESOURCES IN THE TEXAS HIGH PLAINS,** International Bank for Reconstruction and Development, Washington, D. C.  
For primary bibliographic entry see Field 3F.  
W77-00122

**A STABLE ESTIMATOR FOR LINEAR MODELS 1. THEORETICAL DEVELOPMENT AND MONTE CARLO EXPERIMENTS,** Pavia Univ. (Italy).  
For primary bibliographic entry see Field 4A.  
W77-00123

**A METHOD FOR SELECTING AND EVALUATING SIMULATION GAMES AS EDUCATIONAL TOOLS FOR WATER RESOURCES PLANNING,** Massachusetts Univ., Amherst. Water Resources Research Center.  
L. G. Lockwood, and R. F. Powers.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-258 856.  
Price codes: A05 in paper copy, A01 in microfiche.  
WRRS Pub. No. 74, Completion Report FY-76-18, June 1976. 81 p. 116 ref. OWRT A-072-MASS(I). 14-34-0001-6022.

**Descriptors:** Water resources, \*Planning, \*Methodology, Education, Design criteria, Evaluation, \*Simulation analysis.

Objectives were to: (1) develop a methodology for evaluating role-playing simulation games as training devices for students and practitioners in environmental fields; (2) apply this methodology to selected role-playing simulation games currently employed or proposed for employment in the water resources fields; and (3) recommend criteria for selection of simulation games for uses in the water resources fields. Each objective was successfully met, and a new methodology for the selection and evaluation of educational simulation games in the environmental fields was developed. The methodology should be applicable to a wide range of educational simulation game, and facilitate the statement and clarification of instructional objectives for these games. A comprehensive analytical framework is provided for examining the major dimensions of a simulation game which include the following: (1) instructional objectives; (2) practical aspects; (3) design characteristics; (4) degree of reality; and (5) degree of complexity.  
W77-00148

**A BALANCED REGIONAL INPUT-OUTPUT MODEL FOR IDENTIFYING RESPONSIBILITY FOR POLLUTION CREATED BY INDUSTRIES WHICH SERVE NATIONAL MARKETS,** State Univ. of New York at Binghamton. School of Management.  
For primary bibliographic entry see Field 5G.  
W77-00382

### 6B. Evaluation Process

**THE USE OF CONTINUOUS SIMULATION IN THE EVALUATION OF WATER QUALITY MANAGEMENT PLANS,** Hydrocomp, Inc., Palo Alto, Calif.  
For primary bibliographic entry see Field 5G.  
W77-00001

**DAMS AND PEOPLE: GEOGRAPHIC IMPACT AREA ANALYSIS,** Kentucky Water Resources Research Inst., Lexington.  
V. E. Arnett, and S. Johnson.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-258 843.  
Price codes: A07 in paper copy, A01 in microfiche.

Research Report No. 97, September 1976. 122 p, 26 tab, 33 ref. OWRT A-056-KY(1). 14-31-0001-5017.

Descriptors: Community development, \*Social aspects, \*Social impact, Social change, Planning, \*Multiple-purpose reservoirs, \*Attitudes, Water resources development, Regions, Regional analysis, \*Kentucky, Environmental effects.  
Identifiers: \*Impact area analysis.

An attempt is made to determine the efficacy of using geographic impact areas as analytical subgroups for the assessment of the impact of multiple-purpose reservoir projects on target communities. The impact areas utilized are: the take area; the below-the-dam area; the urban area; and, the adjacent area. Each area is described in detail and each is analyzed for differences in knowledge, previous experience, and perception of impact on community and family. Data originated from structured and open-ended interviews in Johnson County, Kentucky. Information was collected during two field efforts, in February, 1974, and in August 1974. Frequency of response and content analysis are the chief analytical devices. Descriptions of the life styles of each region indicated significant differences exist between impact areas. In addition, findings concerning the key variables of knowledge, previous experience, and perception of impact support the efficacy of impact area analysis. Different impact areas represent different orientations to reservoir projects. These differences must be considered for a better understanding of the social impact of such reservoir projects. (Huffsey-Kentucky)  
W77-00008

**URBAN SLUDGE DISPOSAL OR UTILIZATION ALTERNATIVES, SOCIO-ECONOMIC FACTORS.**  
Environmental Protection Agency, Philadelphia, Pa. Region III.  
For primary bibliographic entry see Field 5E.  
W77-00013

**INTER-PLAN COMMUNICATION AND MOTIVATION STUDY, FINAL REPORT, FLORIDA BACKGROUND STUDY.**  
Sperry Urban Science Center, Washington, D.C.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-242 181. Price codes: A09 in paper copy, A01 in microfiche. Prepared for National Science Foundation, Washington, D. C., Experimental Research and Development Incentives Office, November 30, 1973. 191 p, 14 fig, 7 tab, 7 append.

Descriptors: \*Decision-making, \*Planning, \*Communications, \*Motivation, \*Institutional constraints, \*Management, \*Florida, Legislation, Government, Land use, Solar radiation, Regional development.  
Identifiers: Tampa Bay Region(FL), Planned Unit Developments(PUDs), Regionalism, Solar energy.

This 6 month study looked into factors which diminish success of innovative public programs and inhibit private investment in helping to solve public sector problems. It focused upon communication and motivation of key decision makers in private and public sectors in and around the Tampa Bay region. Examples of successful and failing projects were analyzed. Study concludes that success of innovative programs is inhibited by lack of understanding of the overall effort and unclear definitions of responsibility, lack of packaging individual innovations into decision alternatives, lack of support for innovations, and lack of input by end-product users. Examples of each of these are given including regional development efforts, solar energy projects, planned unit developments, and legislation efforts. An experiment with the goal of promotion of innovation in the public sector is described. A statewide program, Developments of Regional Impact, has been

chosen because of its spatial and temporal characteristics. Major organizational elements of the experiment are a joint public-private sector committee to improve evaluation methods, an office of experiment management charged with technical control of the entire experiment, and introduction of certain brokerage functions. A successful brokerage undertaking would involve bringing together appropriate technology, planning and defining responsibilities of key people, supporting available innovation, and communicating meaningful information. Results of the experiment may provide useful information for policy guidance in areas of land use planning, environmental protection, revenue sharing, comprehensive planning and regionalism, and Federal-State relationships. (Smith-North Carolina)  
W77-00098

**AN OVERVIEW OF THE IMPACT STUDY OF THE MCCLELLAN-KERR MULTIPLE PURPOSE ARKANSAS RIVER SYSTEM.**  
Institute for Water Resources (Army), Fort Belvoir, Va.  
For primary bibliographic entry see Field 6G.  
W77-00101

**SOCIAL IMPACT ASSESSMENT: AN OVERVIEW.**  
Colorado State Univ. Fort Collins.  
E. Vlachos, W. Buckley, W. J. Filstead, S. E. Jacobs, and M. Maruyama.  
Prepared for US Army Engineer Institute for Water Resources, Fort Belvoir, VA. December 1975. 117 p, 17 fig, 3 tab, 75 ref. DACW31-74-C-0134 to 0139.

Descriptors: \*Social impact, \*Social aspects, \*Water resources development, \*Evaluation, Analytical techniques, \*Methodology, Decision making, Social values, Alternative planning, Cost-benefit analysis, Methodology.  
Identifiers: \*Impact assessment.

Methodological approaches to social impact assessment of water resources projects are discussed. A framework is set forth to carry out such analysis without prescribing rigid formulas. Topics such as the types of social scientists needed to carry out an assessment, useful theories the general orientation of water resources development, are discussed in sufficient detail to give a good start in doing an impact assessment. Four major areas are discussed: Human Community, Methods, Assessment and Evaluation, and Management Considerations. In Human Community, the range of problems encountered when trying to translate the real world into theories, models and paradigms is discussed. Data are difficult to obtain; simplifying assumptions are needed; and models are difficult to validate. In order to carry out assessment a policy and a framework are needed. This can be generated by answering questions such as: What goal values are to be sought.; What are the trends in the realization of water resources values.; and What broad physical and non-physical factors condition such trends. The Methods chapter gives information on social science methodology, data gathering and sources, data organization, and forecasting. Assessment, as distinct from impact analysis, must include someone's evaluation of perceived effects, or alternative actions, and of options expressed in diversified scenarios. As such, evaluative methods must deal with multiple objectives, provide flexibility, and include both monetary and non-monetary aspects for each alternative. A summary lists recommendations, including a series of pilot sites, a state-of-the-art study in specific situations, and a long range research plan. (Smith-North Carolina)  
W77-00103

**PENNSYLVANIA TRIES NEW WATER QUALITY MANAGEMENT PLAN.**  
Pennsylvania Dept. of Environmental Resources, Harrisburg.

For primary bibliographic entry see Field 5G.  
W77-00107

**THE RELEVANCE OF TECHNOLOGICAL CHANGE IN LONG TERM WATER RESOURCE PLANNING.**  
Colorado Univ., Boulder. Dept. of Economics.  
R. G. Kraynick, and C. W. Howe.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-258 719. Price codes: A04 in paper copy, A01 in microfiche. Colorado Environmental Resources Center, Fort Collins, Completion Report Series No. 74, October 1976. 51 p, 5 fig, 8 tab, 24 ref. OWRT A-022-COLO(1).

Descriptors: \*Long-term planning, \*Cost analysis, Statistical methods, Construction costs, Risks, \*Economies of scale, Water supply development, Technology.  
Identifiers: \*Technological change, Geologic reconnaissance, Cost overruns, Optimal scheduling.

The major part of the investigation derives trends of real unit costs associated with major sub-project tasks of large-scale water projects. Data from U.S. Bureau of Reclamation water supply projects from 1935 to 1970 show that real unit costs of large-scale excavation and other construction operations have declined significantly, but the separation of static scale economy effects from the effects of true technological change poses a difficult problem. A second analysis examines how technological advances may contribute to the reduction of physical and engineering uncertainties in project construction and operation. A specific instance is geologic reconnaissance activities used in water project implementation, an activity which has benefited from great technological advance in the post-war period. Data from U.S. Bureau of Reclamation projects show that there exists a statistically significant negative relationship between expenditures on reconnaissance investigations and geologically related construction cost overruns and post construction failures. The returns to geologic reconnaissance appear to have improved over time, suggesting significant technological improvement. Lastly, a dynamic investment planning model was utilized to determine the impact which inclusion of technological change as manifested in rates of change of the costs of various technologies would have on an optimal scheduling of projects in water supply system development. The results indicate that while some of the low historical rates of real cost reduction have been too low to affect the optimum sequencing of projects, rates well under 1% per annum can significantly change the optimum sequence of projects and the present value of system net benefits.  
W77-00113

**A METHOD FOR SELECTING AND EVALUATING SIMULATION GAMES AS EDUCATIONAL TOOLS FOR WATER RESOURCES PLANNING.**  
Massachusetts Univ., Amherst. Water Resources Research Center.  
For primary bibliographic entry see Field 6A.  
W77-00148

**EFFECTIVENESS OF INFORMATION TRANSFER THROUGH WATER RESOURCES RESEARCHER/USER GROUP INTERACTION.**  
Massachusetts Univ., Amherst. Water Resources Research Center.  
For primary bibliographic entry see Field 10D.  
W77-00151

**A CASE STUDY OF CITIZEN PARTICIPATION IN RESOURCE PLANNING: THE CRAWFORD COUNTY CRITICAL RESOURCE INFORMATION WORKSHOP.**  
Wisconsin Univ., Madison. Inst. for Environmental Studies.

## Field 6—WATER RESOURCES PLANNING

### Group 6B—Evaluation Process

IES Report 44, January 1975. 61 p. 12 fig., 4 tab., 8 ref.

Descriptors: \*Census, \*Social participation, \*Natural resources, Planning, Methodology, \*Wisconsin, Agriculture, Forests, Wildlife, Wetlands, Grasslands, Land use, Geology, Social aspects, History, Scenery, Mineralogy, Water resources.

Identifiers: Critical Resource Information Program, Crawford County (Wis), Delbecq Nominal Group Technique, Delphi method.

The Critical Resource Information Program (CRIP), intended to define and inventory the critical resources of the state of Wisconsin, was tested in Crawford County. CRIP offers a means of identifying, locating, and assessing the high quality resources in the state, though it will not provide a complete resource inventory. Ten resource categories were chosen for investigation: minerals; special geologic features; agricultural land; water; cultural, historical, architectural or archeological features; forests; wildlife; scenic areas; wetlands; and grasslands. One of the major needs of CRIP is to obtain local perspectives of these resources. This was accomplished in Crawford County through the use of the Delbecq Nominal Group Technique, a combination of the Delphi and brainstorming methods. Approximately 45 participants were chosen by University Extension agents and key resources personnel in the County to work in small workshops on each of the resource categories. Resource areas were identified and weighed. The findings are reported and an independent assessment of potentially critical areas is included for those resource categories (agricultural lands, minerals, and wildlife) where generally available data make it possible. A set of detailed maps were prepared based on the discussions, and given to the County Board. (Luedtke-Wisconsin) W77-00171

**WATER PROBLEMS AND PROPERTY RIGHTS—AN ECONOMIC PERSPECTIVE**, Washington State Univ., Pullman. Dept. of Agricultural Economics. C. D. Dittwiler. Natural Resources Journal, Vol. 15, No. 4, p. 663-680, 1975. 6 ref.

Descriptors: \*Water allocation (Policy), \*Water rights, \*Economic efficiency, Water management (Applied), Riparian rights, Appropriation, Pueblo water rights, Usufructuary right, Costs, Benefits, Water supply, Water demand, Water utilization, Public rights.

Identifiers: Correlative water rights.

Significant property rights questions with respect to water are discussed from an economic perspective. The major problem considered is the efficient use of water, which is dependent upon the water allocation or transfer mechanism. This mechanism affects the quantity and mix of goods and services produced by a society as well as the distribution of wealth. It should allocate water resources between alternative users and over time in such a way that an equal value is obtained from the marginal units of all uses. Riparian, appropriative, correlative, pueblo, public ownership, and usufructuary water rights systems relevant to water allocation and use are discussed. Existing water law allocation/transfer criteria include: beneficial use; use preference; temporal priority; non-regulated uses over regulated uses; pre-permit uses over permit uses; priority with respect to source of water; priority of minimum or base flows over permit uses; economic consumptive use over physical consumptive use; and no injury proviso. Alternative approaches, including both planned and unplanned change, are set out along with some elements of the costs and benefits of achieving these respective changes. (Luedtke-Wisconsin) W77-00174

### BALANCING ENVIRONMENTAL QUALITY, ENERGY USE, AND GROWTH: DIFFICULT DECISIONS

Energy Research and Development Administration-Fossil Energy, Washington, D. C. For primary bibliographic entry see Field 6G. W77-00175

**OFFSHORE INDUSTRIAL-PORT ISLANDS**, Delaware Univ., Newark. Coll. of Marine Studies. For primary bibliographic entry see Field 5G. W77-00176

**CONCEPTUAL FRAMEWORK OF ENVIRONMENTAL MANAGEMENT**, Cleveland Dept. of Public Utilities, Ohio. Div. of Utilities Engineering. For primary bibliographic entry see Field 6G. W77-00178

**USING LINEAR PROGRAMMING TO EVALUATE AGRICULTURAL FLOOD CONTROL PROJECTS**, Economic Research Service, Berkeley, Calif. Natural Resource Economics Div. For primary bibliographic entry see Field 3F. W77-00180

**THE BUDDING ENVIRONMENTAL CLEAN-UP (A VIEWPOINT): PART I. POLLUTION AND ENVIRONMENT**, Bordeaux-1 Univ., Talence (France). Dept. of Geography. For primary bibliographic entry see Field 5G. W77-00194

**FISHERIES MANAGEMENT AND SOCIAL CONTEXT: THE CASE OF THE MAINE LOBSTER FISHERY**, National Marine Fisheries Service, Washington, D. C. Fisheries Management Div. J. M. Acheson. Transactions of the American Fisheries Society, Vol. 104, No. 4, p. 653-668, 1975. 13 ref.

Descriptors: \*Fish management, \*Social aspects, \*Institutional constraints, Attitudes, Lobsters, Political aspects, \*Maine, Legislation, \*Marine fisheries, Social aspects.

Identifiers: Cultural aspects.

The necessity for considering basic social and cultural aspects of fishing communities along with the fisheries resource itself in promoting fisheries management schemes is argued. Forty-eight Maine lobster fishermen were interviewed to discover what types of biologically viable management strategies would solve their over-fishing problems and would be acceptable to the fishing industry. Five kinds of management proposals designed to decrease fishing effort are discussed against the background of certain key institutional features of these coastal communities. Social and cultural features examined include the idea of territoriality, the harbor gang or social reference group, the emphasis on fairness and equal use of resources, and the dislike of part-time fishermen. Results suggest that attempts to decrease fishing effort by a moratorium on fishing, by taxation, or by biological controls such as raising the legal carapace size, would be strongly resisted. On the other hand, a trap limit and a limited entry licensing scheme would be consistent enough with some institutional features, such as territoriality, that they would receive considerable political support. In general, they tend to favor legislation that will either increase or not effect their income, or that formalizes cultural institutions already in existence. (Luedtke-Wisconsin) W77-00383

**THE INTEGRATION OF ENVIRONMENTAL AND DEVELOPMENT PLANNING FOR ECOLOGICAL CRISIS AREAS IN AFRICA**, Nairobi Univ. (Kenya). Dept. of Geography. For primary bibliographic entry see Field 6G. W77-00385

**BLUE GOLD: MARICULTURE OF THE EDIBLE BLUE MUSSEL (MYTILUS EDULIS)**, Harvard Univ., Cambridge, Mass. Administrative Services. For primary bibliographic entry see Field 6C. W77-00386

**EVALUATION OF RECREATIONAL SITES**, Clemson Univ., S. C. Dept. of Forestry. C. L. Lane, W. P. Byrd, and H. Brantley. Journal of Leisure Research, Vol. 7, No. 4, p. 296-300, 1975. 2 tab., 9 ref.

Descriptors: \*Recreation, \*Sites, \*Attitudes, \*Evaluation, Methodology, Photography, \*South Carolina, \*Recreation facilities, Social aspects.

In an attempt to evolve a labor and cost saving method of determining recreational site preferences, color slides were presented to five groups of resource-oriented students at Clemson University, South Carolina. Each group had visited and evaluated the respective sites previously. The preference of a site when viewed on slides differed significantly from preference used on actual viewing of the site. The sites were rated differently by the five student groups resulting in a significant student section-by-site interaction. The study was initiated on the assumption that the use of panoramic color slides would be a realistic method of determining preferences of large numbers of students in a short period of time. However, when compared to on-site viewing, this method of presentation indicated that it was not a reliable means of determining preferences. Even though the students will be resource managers and were therefore more homogeneous than a sample of the total population all groups did not score the sites the same. Consequently, determining the site preference of a heterogeneous cross section of the general population by photographic methods would be unrealistic. (Auen-Wisconsin) W77-00387

**DECISION-MAKING IN RECREATIONAL FISHERIES MANAGEMENT: AN ANALYSIS**, Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Fisheries and Wildlife Sciences. J. E. Powers, R. T. Lackey, and J. R. Zuboy. Transactions of the American Fisheries Society, Vol. 104, No. 3, 630-634, 1975. 1 fig., 28 ref.

Descriptors: \*Decision making, \*Fish management, \*Computer programs, \*Methodology, Fisheries, Recreation, Planning.

Identifiers: \*Recreational fisheries.

A computer-oriented model is proposed to systematize the decision-making process in recreational fisheries management. The model reduces a complex process into tangible segments so that areas of weakness may be identified, then it is reduced to solvable components. Step 1 selects the management objectives—the key point in the process; the method of selection is described. Step 2 is an assessment whether the selected objectives are met. Step 3 surveys alternative strategies; Step 4 evaluates alternative strategies; Step 5 defines whether the objectives are reachable, with sub-step 5-A to determine whether research is needed to develop or evaluate a potential management solution. The final Step 6, implements the best strategy. The decision process should be continued by monitoring to determine if the management strategy is effective, and the entire decision-making process must be continually re-evaluated. (Auen-Wisconsin) W77-00391



**6C. Cost Allocation, Cost Sharing, Pricing/Repayment**

**COMPUTER EVALUATION OF SLUDGE HANDLING AND DISPOSAL COSTS,**  
Municipal Environmental Research Lab., Cincinnati, Ohio.  
For primary bibliographic entry see Field 5D.  
W77-00012

**REVIEW OF THE MUNICIPAL WASTE WATER TREATMENT WORKS PROGRAM,**  
Environmental Protection Agency, Washington, D.C. Construction Grants Review Group.  
For primary bibliographic entry see Field 5D.  
W77-00043

**REMOVAL VS BENEFITS: IT CAN BE TOO COSTLY,**  
Kansas City Water and Pollution Control Depts., Mo.  
For primary bibliographic entry see Field 5D.  
W77-00044

**DISCOUNTED CASH FLOW ANALYSIS TO SELECT EQUIPMENT,**  
Entech Corp., Dumont, N. J.  
For primary bibliographic entry see Field 5D.  
W77-00049

**IS NUTRIENT REMOVAL WORTHWHILE,**  
Iowa State Univ., Ames, Dept. of Animal Ecology.  
For primary bibliographic entry see Field 5D.  
W77-00065

**SEWERING THE CITY OF NEW YORK,**  
New York City Environmental Protection Administration.  
For primary bibliographic entry see Field 5D.  
W77-00070

**MAINE SEWER BID 39% BELOW ESTIMATE.**  
For primary bibliographic entry see Field 5D.  
W77-00071

**AN OVERVIEW: SO YOU WANT TO RECYCLE YOUR WASTEWATER. HOW SHOULD YOU BEGIN. IS IT FEASIBLE,**  
For primary bibliographic entry see Field 5D.  
W77-00079

**THE RELEVANCE OF TECHNOLOGICAL CHANGE IN LONG TERM WATER RESOURCE PLANNING,**  
Colorado Univ., Boulder, Dept. of Economics.  
For primary bibliographic entry see Field 6B.  
W77-00113

**ENVIRONMENT, ENERGY, AND CAPITAL IN THE FOSSIL FUELED ELECTRIC POWER INDUSTRY,**  
Houston Univ., Tex.  
For primary bibliographic entry see Field 3E.  
W77-00118

**WEATHER-DEPENDENT PRICING FOR WATER RESOURCES IN THE TEXAS HIGH PLAINS,**  
International Bank for Reconstruction and Development, Washington, D. C.  
For primary bibliographic entry see Field 3F.  
W77-00122

**COPING WITH INCREASING COSTS,**  
Black and Veatch, Kansas City, Mo.  
For primary bibliographic entry see Field 3D.

W77-00172

**A REGIONAL MARKET FOR RIGHTS TO USER FERTILIZER AS A MEANS OF ACHIEVING WATER QUALITY STANDARDS,**  
Illinois Univ. at Urbana-Champaign. Dept. of Agricultural Economics.  
For primary bibliographic entry see Field 5G.  
W77-00173

**MARINE SAND AND GRAVEL MINING,**  
Geological Survey, Menlo Park, Calif. Conservation Div.  
For primary bibliographic entry see Field 3E.  
W77-00195

**ECONOMICS OF INCREASED MOBILITY FROM TILE DRAINAGE,**  
Mosul Univ. (Iraq). Coll. of Engineering.  
For primary bibliographic entry see Field 3F.  
W77-00313

**A SYSTEMATIC PROCEDURE FOR TAXING AGRICULTURAL POLLUTION SOURCES,**  
Colorado State Univ., Fort Collins. Dept. of Agricultural Engineering.  
For primary bibliographic entry see Field 5G.  
W77-00314

**A BALANCED REGIONAL INPUT-OUTPUT MODEL FOR IDENTIFYING RESPONSIBILITY FOR POLLUTION CREATED BY INDUSTRIES WHICH SERVE NATIONAL MARKETS,**  
State Univ. of New York at Binghamton. School of Management.  
For primary bibliographic entry see Field 5G.  
W77-00382

**BLUE GOLD: MARICULTURE OF THE EDIBLE BLUE MUSSEL (MYTILUS EDULIS),**  
Harvard Univ., Cambridge, Mass. Administrative Services.  
C. G. Hurlburt, and S. W. Hurlburt.  
Marine Fisheries Review, Vol. 37, No. 10, p. 10-18, 1975.

Descriptors: \*Aquiculture, \*Shellfish farming, \*Mussels, Europe, Coasts, Economic feasibility, Growth rates, United States, Methodology, Byproducts, Marketing.  
Identifiers: \*Mytilus edulis, France, Netherlands, Spain, Mussel mariculture, Depuration.

The high nutritional value and the feasibility of mussel (*Mytilus edulis*) mariculture is discussed. In Europe mussels are grown in different ways depending on the coastal geography and heights of tides. In northwest Spain, ropes are attached to rafts and extend about 30 feet down. Young seed mussels are collected and wrapped on the ropes until they become attached. They require 12-18 months to mature. An acre produces over 250,000 pounds of meat annually. A pole or 'bouchet' method is used along the Atlantic coast of France. Growth requires 12-18 months. An acre will yield over 4000 pounds of meat annually. In the Netherlands mussels are grown on the bottom of shallow, enclosed seas, but harvesting, cleaning, and storage is mechanized. About 20 months is required for their growth. An improved mechanized method for cleaning and storage is being developed in the Netherlands. Over 15,000 pounds of meat per acre are produced annually. Mussel culture can easily be adapted to the United States, depending on geographic and tidal conditions. Cubic, submerged growth, as in Spain, gives the best yields. Mussels are a very efficient producers of edible flesh. It could be the cheapest, most nutritious, and most abundant meat supply in the world. (Buchanan-Davidson-Wisconsin).  
W77-00386

**FORECASTS OF ATLANTIC AND GULF MENHADEN CATCHES BASED ON THE HISTORICAL RELATION OF CATCH AND FISHING EFFORT,**  
National Marine Fisheries Service, Beaufort, N. C. Atlantic Estuarine Fisheries Center.  
W. E. Schaaf, J. E. Sykes, and R. B. Chapoton.  
Marine Fisheries Review, Vol. 37, No. 10, p. 5-9, 1975. 1 fig., 2 tab., 18 ref.

Descriptors: \*Forecasting, \*Marine fisheries, \*Fish harvest, \*Atlantic menhaden, Fishing, Gulf of Mexico, Atlantic Ocean, Mathematical models.  
Identifiers: \*Gulf menhaden.

A multiple regression equation employing the empirical relation between catch and fishing effort estimates the annual catch. The total catch was used because (1) for the Atlantic fishery it is difficult to prorate effort on different ages, and (2) for the Gulf, aging is more uncertain; but there are fewer age classes in the fishery. The multiple regression used accounted for 85% of the variance in the Atlantic catches and 86% in Gulf catches. Observed Atlantic catches deviated from the forecasts by 9% in 1973 and 22% in 1974. The errors for the Gulf were 2% in 1973 and 1% in 1974. A measure of the incoming year class would permit development of short-term fishing strategies to take advantage of exceptional year classes or to prevent overexploitation of weak year classes. The model represents a progress report as other models, including more variables, are being considered. (Auen-Wisconsin)  
W77-00388

**STATUS OF THE GULF AND ATLANTIC MANHADEN FISHERIES AND IMPLICATIONS FOR RESOURCE MANAGEMENT,**  
National Marine Fisheries Service, Beaufort, N. C. Atlantic Estuarine Fisheries Center.  
W. B. Schaff.  
Marine Fisheries Review, Vol. 37, No. 9, p. 1-9, 1975. 5 fig., 3 ref.

Descriptors: \*Marine fisheries, \*Atlantic menhaden, \*Fish management, Planning, Fish harvest, Fishing, Fish populations, Regulation, Commercial fishing, Model studies, Return(Monetary), Gulf of Mexico, Atlantic Ocean.  
Identifiers: \*Gulf menhaden.

The knowledge of the Atlantic and Gulf menhaden fisheries is summarized together with their problems. Some tentative solutions are offered and those problem areas which preclude an optimal management plan are indicated. The thrust of the discussion is toward the biological aspect of the resource and its response to harvesting at various intensity levels, as related to the total yield and the yield per unit of fishing effort. While catch limitations are the easiest to implement and will achieve the maximum sustainable yield (MSY), from the economic rationale it is necessary to limit the amount of effort and to do so in a manner that does not deter harvesting efficiency. In view of the technical difficulties of implementing any management scheme, the policy difficulties in determining an optimum strategy, and the inherent volatility of many fisheries, the option is to attain minimal objectives with a quota system as an initial step. Setting annual quotas, with adjustments in response to fluctuations in the size of incoming classes, would allow the industry to approach the peak of production systematically and gradually. Effort would be closely monitored each year to help determine the validity of the estimated MSY. This first management step would prevent both overfishing and economic difficulties for the industry, while other management plans are optimized. (Auen-Wisconsin)  
W77-00389

**EFFLUENT CHARGES AND POLITICAL REALITIES—A QUALIFICATION,**  
Pennsylvania State Univ., University Park. Dept. of Economics.

## Field 6—WATER RESOURCES PLANNING

### Group 6C—Cost Allocation, Cost Sharing, Pricing/Repayment

For primary bibliographic entry see Field 5G.  
W77-00392

**THE COST OF PHYSICAL CHEMICAL TREATMENT (PCT) WASTE WATER,**  
Commonwealth Scientific and Industrial Research Organization, Melbourne (Australia). Div. of Chemical Technology.  
For primary bibliographic entry see Field 5D.  
W77-00445

**CENTRIFUGE PLUS LIME LIMITS LIGNIN IN WASTE WATER,**  
For primary bibliographic entry see Field 5D.  
W77-00464

**ENVIRONMENTAL CONSIDERATIONS IN EXPANDING AGRICULTURAL PRODUCTION,**  
Latin American Program for Resources for the Future, Inc., Washington, D.C.  
For primary bibliographic entry see Field 6G.  
W77-00470

### 6D. Water Demand

**DIGITAL SIMULATION OF A BASALT AQUIFER SYSTEM, WALLA WALLA RIVER BASIN, WASHINGTON AND OREGON,**  
Geological Survey, Tacoma, Wash.  
For primary bibliographic entry see Field 4B.  
W77-00481

**CHANGES IN THE WATER SUPPLY IN THE UPPER REPUBLICAN NATURAL RESOURCES DISTRICT, SOUTHWEST NEBRASKA, FROM 1952-75,**  
Geological Survey, Lincoln, Nebr.  
For primary bibliographic entry see Field 4B.  
W77-00489

### 6E. Water Law and Institutions

**INSTITUTIONAL PROBLEMS OF THE SMALL TREATMENT PLANT,**  
Environmental Quality Systems, Inc., Rockville, Md.  
For primary bibliographic entry see Field 5D.  
W77-00010

**INTER-PLAN COMMUNICATION AND MOTIVATION STUDY, FINAL REPORT, FLORIDA BACKGROUND STUDY,**  
Sperry Urban Science Center, Washington, D.C.  
For primary bibliographic entry see Field 6B.  
W77-00098

**SOME THOUGHTS ON ZERO DISCHARGE,**  
Monroe County Drain Commission, Mich.  
For primary bibliographic entry see Field 5G.  
W77-00125

**WATER PROBLEMS AND PROPERTY RIGHTS—AN ECONOMIC PERSPECTIVE,**  
Washington State Univ., Pullman. Dept. of Agricultural Economics.  
For primary bibliographic entry see Field 6B.  
W77-00174

**MANAGEMENT OF THE OCEAN'S LIVING RESOURCES: AN ESSAY REVIEW,**  
National Marine Fisheries Service, Seattle, Wash. Northwest Fisheries Center.  
D. L. Alverson.  
Ocean Development and International Law Journal, Vol. 3, No. 2, p. 99-125, 1975. 15 ref.

Descriptors: \*Law of the Sea, \*Marine fisheries, Resource allocation, Law enforcement, \*Oceans, Jurisdiction, International waters, Institutions, Governments, \*Management, Legal aspects, Political aspects, Fish harvest, Optimization.

A series of Resources for the Future (RFF) and American Society of International Law (ASIL) publications are reviewed to provide an overview and perspective on the management of the ocean's living resources in connection with the Third United Nations Conference on Law of the Sea. The six RFF papers are all oriented toward the theme of alternative arrangements for managing marine fisheries, while the ASIL report proposes eight principles as a rational basis for constructing a new international fisheries regime. Problems discussed are grouped under four areas: technical, legal and institutional, enforcement, and conference-associated. Technical problems considered are the (1) mobility of fisheries resources, (2) dynamic nature of marine fisheries resources, (3) ecological and harvesting gear interactions, (4) cost and difficulty acquiring credible biological and statistical information, and (5) communication failures between technical disciplines and between the scientific community and decision makers. Legal and institutional problems considered are: (1) No satisfactory right of property, (2) the distribution of wealth, (3) settlement of international dispute mechanisms, (4) the limited authority vested in management institutions, and (5) the rapid rate of change in modern fisheries. Proposed alternatives and recommendations are summarized and evaluated. (Luedtke-Wisconsin)  
W77-00179

**THE ENVIRONMENT AND THE STRUCTURE OF SOCIAL GOALS,**  
For primary bibliographic entry see Field 5G.  
W77-00181

**FISHERIES MANAGEMENT AND SOCIAL CONTEXT: THE CASE OF THE MAINE LOBSTER FISHERY,**  
National Marine Fisheries Service, Washington, D. C. Fisheries Management Div.  
For primary bibliographic entry see Field 6B.  
W77-00383

**THE INTEGRATION OF ENVIRONMENTAL AND DEVELOPMENT PLANNING FOR ECOLOGICAL CRISIS AREAS IN AFRICA,**  
Nairobi Univ. (Kenya). Dept. of Geography.  
For primary bibliographic entry see Field 6G.  
W77-00385

**EFFLUENT CHARGES AND POLITICAL REALITIES—A QUALIFICATION,**  
Pennsylvania State Univ., University Park. Dept. of Economics.  
For primary bibliographic entry see Field 5G.  
W77-00392

**BASF COMPLETES TEN-YEAR PROJECT FOR CLEANING UP THE RHINE,**  
For primary bibliographic entry see Field 5D.  
W77-00403

**IOWA'S EXPERIENCE WITH A MANDATORY SEDIMENT CONTROL LAW,**  
Iowa Dept. of Soil Conservation, Des Moines.  
W. H. Greiner.  
Journal of Soil and Water Conservation, Vol. 30, No. 3, May-June 1975. p 132-134.

Descriptors: \*Sediment control, \*Sediments, \*Legislation, \*Iowa, Erosion, Erosion control, Soil erosion, Water quality control.  
Identifiers: \*Sediment control laws.

Before the mid-1960s, sediment control laws were seldom discussed in Iowa, but a chain of events took place that brought these words into prominence. Iowa was one of the first states to enact a sediment control law. Many people refer to the law as landmark legislation because no other state has a law that deals with soil erosion to the extent this one does. The law surely has had an impact on conservation district programs in Iowa, but it is in no sense a model law. Compromises preceded its enactment. As a result, some sections of the law are not as strong as they could be. (Skogerboe-Colo St)  
W77-00477

### 6F. Nonstructural Alternatives

**FLOOD HAZARD ANALYSIS: CROOKED RIVER, TOWN OF CASCO, TOWN OF NAPLES, CUMBERLAND COUNTY, MAINE,**  
Soil Conservation Service, Orono, Maine.  
For primary bibliographic entry see Field 4A.  
W77-00100

**FLOOD PLAIN INFORMATION: REPORT ON RANOCAS CREEK, BURLINGTON COUNTY, NJ (SUMMARY REPORT),**  
Army Engineer District, Philadelphia, Pa.  
For primary bibliographic entry see Field 4A.  
W77-00102

**FLOOD PLAIN INFORMATION: SOUTHAMPTON COUNTY, VIRGINIA,**  
Army Engineer District, Norfolk, Va.  
For primary bibliographic entry see Field 4A.  
W77-00104

**FLOOD PLAIN INFORMATION: RESUR-RECTION RIVER AND SALMON CREEK, ALASKA,**  
Army Engineer District, Anchorage, Alaska.  
For primary bibliographic entry see Field 4A.  
W77-00105

### 6G. Ecologic Impact Of Water Development

**DAMS AND PEOPLE: GEOGRAPHIC IMPACT AREA ANALYSIS,**  
Kentucky Water Resources Research Inst., Lexington.  
For primary bibliographic entry see Field 6B.  
W77-00008

**AN OVERVIEW OF THE IMPACT STUDY OF THE MCCLELLAN-KERR MULTIPLE PURPOSE ARKANSAS RIVER SYSTEM,**  
Institute for Water Resources (Army), Fort Belvoir, Va.  
L. G. Antle.  
Available from the National Technical Information Service, Springfield, Va 22161 as AD/A-014 975. Price codes: A03 in paper copy, A01 in microfiche. IWR Research Report 76-R3. July 1975. 35 p, 3 fig, 1 plate, 5 tab, append.

Descriptors: \*Watershed management, \*River systems, \*Cost-benefit analysis, \*Decision making, Navigation, Flood protection, Recreation, Water supply, Sediment control, Hydroelectric power, \*Multiple-purpose reservoirs, Multiple-purpose projects, Arkansas, Oklahoma. Identifiers: \*Arkansas River(AR-OK), \*Impact assessment, Socioeconomic development, Public involvement.

Interim conclusions are discussed on the impacts of the completed McClellan-Kerr Arkansas River Project in Arkansas and Oklahoma. In the 4 reports completed to date, the approach to impact

analysis was to begin with physical changes in the river regimen introduced by the project, determine the uses made by people of the changes, trace the changes through higher order impacts, and then weigh these impacts by the values placed on them from a number of perspectives. The 4 completed reports concern: project use, socioeconomic profiles, commodity shipments on the Arkansas River system, and port development. Interim conclusions indicate that impacts were not anticipated and the more significant impacts become obvious only after careful study. During the first year of operation of the system, benefits of users approached costs, but the mix of benefits is quite different than anticipated. Navigation benefits are substantial and probably will exceed forecasts within 10 years. Power benefits are lower, but recreation benefits are significantly higher than predicted. Because of regional differences, benefits and costs are not perceived evenly, and development has occurred differently because of this. In Arkansas, industrial development is proceeding well. Of particular interest is the decision-making process which was followed in developing the implemented plan. There was a persistent conflict between regional and national goals, and the failure to develop considerable waterfront property is seen to have been caused by a lack of follow-through. An appendix focuses on some benefits: navigation, hydroelectric, recreation, sediment control, transportation. (Smith-North Carolina)

W77-00101

#### ENVIRONMENTAL EFFECTS OF ALTERNATIVE ENERGY DEVELOPMENTS IN THE NORTHERN GREAT PLAINS,

United Nations, New York.  
R. A. Luken, and E. H. Pechan.

Computers and Operations Research, Vol 3, No 2/3, p 259-268, August 1976. 3 fig, 7 tab, 19 ref.

Descriptors: \*Environmental effects, \*Energy, \*Model studies, Water, Air, Pollution abatement, Control, Technology, Estimating, Economics, Operations research.

Identifiers: \*Northern Great Plains, Residuals.

A model used to characterize environmental conditions in the five-state northern Great Plains region is described. The current conditions and the expected conditions resulting from the development of the region's energy resources are compared with a focus on residuals emitted into the air and water and their relation to other parameters which describe the region. The model relates the levels of current and future economic and demographic activities to the quantities of residuals discharged into the environment. These quantities can be adjusted based on control technology used. Various scenarios of energy resource (primarily coal) development in the region are investigated and comparisons are made between (1) current activity levels and current controls, (2) current activity levels and expected controls, and (3) various future activity levels and future controls. Key residuals studied are particulates, sulfur oxides, biological oxygen demand, and suspended solids. Results of the analysis can be used to evaluate development policies. The various development alternatives can be compared with the present (base) case, and the future case, with no additional energy resource development. (Bell-Cornell)

W77-00115

#### A COMPUTERIZED SYSTEM FOR WILD LAND USE PLANNING AND ENVIRONMENTAL IMPACT ASSESSMENT,

Washington Univ., Seattle. Coll. of Forest Resources.

G. F. Schreuder, K. P. Rustagi, and B. B. Bare. Computers and Operations Research, Vol. 3, No. 2/3, p 217-228, August 1976. 2 fig, 2 ref.

Descriptors: \*Land use, \*Assessment, \*Simulation analysis, \*Environment, \*Computer

models, Data storage and retrieval, Decision making, Management, Hydrologic aspects, Forest management, Recreation, Fish, Wildlife, Operations research.

Identifiers: \*Wild lands, Timber production, \*Environmental impact.

A computerized system useful for examining the physical, economic, and environmental consequences of alternative wild land use decisions is described. The system consists of a set of simulation models linked to a geographic data base by an information storage and retrieval subsystem. The simulation models cover forest production, timber harvesting, recreation, fish-wildlife-insect dynamics, and atmospheric and hydrologic processes. System inputs consist of land-use and management decision alternatives. The consequences of these system inputs can be evaluated at varying scales of spatial and temporal resolutions in terms of goods, services, and environmental impacts. Uses to data suggest that the system is a valuable aid to land-use planners and forest management decision makers. (Bell-Cornell)

W77-00119

#### SOME THOUGHTS ON ZERO DISCHARGE,

Monroe County Drain Commission, Mich.

For primary bibliographic entry see Field 5G.

W77-00125

#### BALANCING ENVIRONMENTAL QUALITY, ENERGY USE, AND GROWTH: DIFFICULT DECISIONS,

Energy Research and Development Administration-Fossil Energy, Washington, D. C.

F. H. Abel.

American Journal of Agricultural Economics, Vol. 57, No. 5, p. 815-818, 1975. 8 ref.

Descriptors: \*Energy, \*Simulation analysis, \*Econometrics, Social aspects, Evaluation, Environment, Welfare(Economics), Cost-benefit analysis, Gross National Product, Decision making, Marginal costs, Marginal benefits, Water pollution effects, Air pollution effects, Model studies. Identifiers: \*Environmental quality, Quality of life, Economic growth, Energy self-sufficiency, Strategic Environmental Assessment System, Chase econometric model, Almond interindustry model.

The relationships between three major issues, environmental quality, economic growth, and energy self-sufficiency are examined. It is concluded that an adequate framework for analyzing the trade-off between these issues does not exist, and a single quality of life function cannot be estimated. The most realistic method of analysis is a trade-off analysis where the level of all major factors are estimated for each policy option, but this leaves the decision maker with the task of comparing noncommensurables. The Strategic Environmental Assessment System (SEAS) developed by EPA is a promising method of predicting this trade-off. Beginning with the Almond Interindustry Model, the system combines fourteen computer models. Economic growth rates, productivity, aggregate demand, and rates of substitution of new cleaner technology for old are inputs, and energy consumption, emissions of forty pollutants, GNP, Unemployment, output, transportation, and investment in plant and equipment are outputs. Some progress is reported in quantifying environmental factors. The best economic measure of changes in environmental quality is suggested to be the estimated damages caused by pollution. Here, imprecise national cost-benefit analysis can be performed, and improved techniques can lead to estimates of marginal costs and benefits needed in trade-off analysis. (Luedtke-Wisconsin)

W77-00175

#### BEWARE THE WRATH OF OSIRIS,

For primary bibliographic entry see Field 4A.

W77-00177

#### CONCEPTUAL FRAMEWORK OF ENVIRONMENTAL MANAGEMENT,

Cleveland D-pt. of Public Utilities, Ohio. Div. of Utilities Engineering.

A. B. Garlauskas.

Journal of Environmental Management, Vol. 3, No. 3, p. 185-203, 1975. 3 fig., 1 tab., 32 ref.

Descriptors: \*Decision making, \*Systems analysis, Management, Environment, Environmental control, Methodology, Ecosystems, Comprehensive planning.

Identifiers: \*Environmental management.

The conceptual framework of environmental management, defined as a systematic and scientific approach to assuring a congruous interface between natural and man-made systems, is explored. Based on an ecosystems/biological sciences perspective the functional premises of environmental management are (1) to prevent irreversible changes in ecology, (2) to assure man's survival and the progressive improvement in his quality of life, and (3) to direct man's processes as parts of evolving nature as opposed to intrusions upon it. Conflicts which arise from the interaction of artificial and natural systems are resolved through the use of these premises. Functionally this can only be accomplished through multidisciplinary knowledge and interdisciplinary approaches. A simplified two-dimensional linear analysis is used to reveal the stress/anti-stress pattern of adjustment of the man-environmental equilibrium. Management of these stresses requires a systems perspective utilizing systems approach, system analysis, and systems management techniques. These concepts and techniques are used to integrate and balance the components of the environmental management framework: Environment, Disruptions, Effects, (Human) Ecosystem, Engineering and Technology and Legal Controls. The practical application of this methodology at the macro-scale level is beyond present capabilities, but the approach can be scaled down and used at the meso- and micro-scale levels. (Luedtke-Wisconsin)

W77-00178

#### THE ENVIRONMENT AND THE STRUCTURE OF SOCIAL GOALS,

For primary bibliographic entry see Field 5G.

W77-00181

#### THE BUDDING ENVIRONMENTAL CLEAN-UP (A VIEWPOINT): PART I. POLLUTION AND ENVIRONMENT,

Bordeaux-1 Univ., Talence (France). Dept. of Geography.

For primary bibliographic entry see Field 5G.

W77-00194

#### EVALUATION OF MULTI-PURPOSE OFFSHORE INDUSTRIAL-PORT ISLANDS. VOL II: MAJOR RESEARCH PROBLEMS AND PROMISING RESEARCH APPROACHES,

Delaware Univ., Newark. Coll. of Marine Studies.

For primary bibliographic entry see Field 8C.

W77-00199

#### A REINVESTIGATION OF SOUTHERN CALIFORNIA ROCKY INTERTIDAL BEACHES THREE AND ONE-HALF YEARS AFTER THE 1969 SANTA BARBARA OIL SPILL: A PRELIMINARY REPORT,

University of Southern California, Los Angeles. Allan Hancock Foundation.

For primary bibliographic entry see Field 5C.

W77-00267

#### TERRESTRIAL OIL SPILLS IN ALASKA: ENVIRONMENTAL EFFECTS AND RECOVERY,

Army Engineer Waterways Experiment Station, Vicksburg, Miss.

For primary bibliographic entry see Field 5C.



## Field 6—WATER RESOURCES PLANNING

### Group 6G—Ecologic Impact Of Water Development

W77-00269

#### A STUDY OF THE EFFECTS OF THE SAN FRANCISCO OIL SPILL ON MARINE ORGANISMS,

College of Marin, Kentfield, Calif.

For primary bibliographic entry see Field 5C.

W77-00270

#### INTERAGENCY INVESTIGATIONS OF A PERSISTENT OIL SPILL ON THE WASHINGTON COAST,

National Marine Fisheries Service, Seattle, Wash.

For primary bibliographic entry see Field 5C.

W77-00271

#### COASTAL ZONE BIBLIOGRAPHY: CITATIONS TO DOCUMENTS ON PLANNING, RESOURCES MANAGEMENT AND IMPACT ASSESSMENT, SECOND EDITION,

California Univ., San Diego, La Jolla. Inst. of Marine Resources.

For primary bibliographic entry see Field 2L.

W77-00277

#### EFFECTS ON COMMERCIAL FISHING OF PETROLEUM DEVELOPMENT OFF THE NORTHEASTERN UNITED STATES,

Woods Hole Oceanographic Institution, Mass.

Marine Policy and Ocean Management Program.

For primary bibliographic entry see Field 5C.

W77-00280

#### ECONOMIC IMPACTS OF STATE ENVIRONMENTAL PROGRAMS IN A NATIONAL FRAMEWORK: THE IOWA CONSERVANCY LAW,

Iowa State Univ., Ames. Center for Agricultural and Rural Development.

E. O. Heady, and V. S. S. V. Nagadevara.

Journal of Soil and Water Conservation, Vol. 30,

No. 6, p. 272-278, November-December, 1975. 3

fig, 5 tab, 8 ref.

Descriptors: \*Legislation, \*Iowa, \*Sediments, \*Erosion, Economics, Economic justification, \*Economic impact.

Identifiers: Sediment damages.

Several states have passed laws to protect prime farm land, reduce environmental impacts, or eliminate off-site sediment damages. The 1971 Iowa legislature, for example, passed the Conservancy District Act to control the use of soil and water resources and thereby limit annual soil loss. Because of the inelastic demands for farm commodities, one state such as Iowa may restrain land use with the result that its farmers sacrifice income while farmers elsewhere gain income. National models were applied to determine what the outcome would be if Iowa were to fully implement its Conservancy District Act or apply other environmental restraints, such as limiting nitrogen and pesticide use. The results show that in all cases restraints implemented solely in Iowa would reduce net farm income in the state while income elsewhere in the nation would increase. Hence, national as opposed to state legislation is implied for the long run. (Skogerboe-Colo St)

W77-00303

#### HYGIENIC PROBLEMS OF ENVIRONMENTAL PROTECTION IN CONNECTION WITH THE FURTHER DEVELOPMENT OF SIBERIA AND THE FAR EAST, (IN RUSSIAN),

For primary bibliographic entry see Field 5G.

W77-00349

#### ENVIRONMENTAL IMPACT OF STREAM CHANNELIZATION,

Baker (Michael), Jr., Inc., Beaver, Pa.

W. A. Duvel, Jr., R. D. Volkmar, W. L. Specht,

and F. W. Johnson.

Water Resources Bulletin, Vol. 12, No. 4, p. 799-

812, August 1976. 4 fig, 2 tab, 13 ref. FC-12453,

FER-128, ARC-73-185-2562.

Descriptors: \*Channels, Streamflow, Channel improvement, Trout, Benthos, Water quality, Hydrology, Freshwater fish, Watersheds(Basins), Flood protection, Environment, \*Pennsylvania, \*Environmental effects.

Identifiers: \*Stream channelization, \*Hurricane Agnes, Watershed characteristics, \*Environment impact studies.

Geologic, engineering, and biological investigations of six Pennsylvania coldwater streams were undertaken to determine the impact of channel modifications instituted both prior to and following Hurricane Agnes. The primary focus of the study was on the ecological changes brought about by stream channelization. No long-term deleterious effects on water quality, attached algae, benthic fauna, or forage fish populations were found. Trout, however, were found to be greater in number and weight in natural than in channelized stream reaches. Lack of suitable physical habitat appeared to be the primary cause of reduced trout populations in stream reaches which have been channelized. (Lee-ISWS)

W77-00375

#### THE INTEGRATION OF ENVIRONMENTAL AND DEVELOPMENT PLANNING FOR ECOLOGICAL CRISIS AREAS IN AFRICA,

Nairobi Univ. (Kenya). Dept. of Geography.

S. H. Ominde.

International Social Science Journal, Vol. 27, No.

3, p. 499-516, 1975. 6 tab., 23 ref.

Descriptors: \*Planning, \*Africa, Resources development, Human population, Urbanization, Rural areas, Industrial production, Regional development, Environmental effects, Social aspects, Management, Foreign countries, Cities, Migration.

Identifiers: \*Developing countries, Environmental quality.

The conceptual framework of development planning and environmental conservation, demographic components, urban and rural environmental management problems, and the basic strategies of integrated development planning in Africa are examined. In developing countries, the planner must control environmental problems resulting from poverty, while at the same time adopt measures to prevent economic growth and industrial development from having an unfavorable impact on the society. Falling mortality rates, rising life expectancy and sustained high birth rates are responsible for the 59% demographic inflation in Africa between 1950 and 1970. Tied to this increase are an accelerating rate of urbanization and the emergence of very large cities. Population growth, however, is only one factor in development problems, not the main cause. Rural development plans must give priority to a regional development concept which promotes a better balance in settlement patterns, a more rational use of resources including the adoption of new technologies, and encourages local participation. Urban development, on the other hand, must be examined with reference to the policy areas of: alternative settlement patterns and city size; strategy for the internal organization of cities; location policies; and strategies for the development of viable growth goals. (Luedtke-Wisconsin).

W77-00385

#### ENVIRONMENTAL FACTORS IN PRODUCING SUPPLEMENTAL FUELS,

M. R. Beychok.

Hydrocarbon Processing, Vol. 54, No. 10, p. 78-

81, 1975. 6 tab, 13 ref. EPA 68-03-2136.

Descriptors: \*Environmental effects, \*Fuels, \*Industrial production, Air pollution, Water pollution, Coal, Oil shales, Methane, Natural gas, Efficiencies, Oxides, Energy.

Identifiers: \*Alternative energy supplies, Synthetic natural gas, Naphtha, Thermal efficiencies.

The degree of air pollution, water utilization, and noise that may be generated by producing supplemental fuels to meet national energy needs are summarized and compared on the basis of tons/unit product Btu output. The industrial processes considered are production of synthetic natural gas from coal, crude oil, and naphtha; production of liquid fuels from oil shale; liquefaction; importing liquid gas (LNG) and as methanol; and regasification of LNG. It is estimated that the extraction of 8 to 12 millions tons/yr of coal will require the surface mining of about 250 to 500 acres/yr or a total of 6300 to 15,000 acres over a 25 to 30 year period. On the assumption that a strip mined area can be regraded and revegetated within five years, the maximum amount of land disturbance at any given time would be 1250 to 2500 acres. Underground oil shale mining will entail the disposal of approximately 22.5 millions tons/yr of wet spent shale which will pose a leaching hazard, plus the revegetation and reclamation of the shale embankment. It is estimated that a 13% fuel supplement to current oil and gas demand would require mining approximately 1 billion tons/yr of coal and oil shale and might involve almost 400,000 acres of land over a 20 to 25 year span. (Auen-Wisconsin)

W77-00390

#### THE EFFECT OF HUMANS ON BIOGEOCENOSSES AND ENVIRONMENTAL PROTECTION, (IN RUSSIAN),

A. K. Rustamov.

Izv Akad Nauk Turkm SSR Ser Biol Nauk. 6, p. 3-

9, 1974.

Descriptors: \*Ecology, \*Environmental effects, \*Radioactivity effects, \*Pesticides, DDT, Industrial wastes, Deserts, Asia, Irrigation practices, Hunting, Mining, Grazing, Construction, Population, \*Environmental control.

Identifiers: Biogenesis, \*Biogeocenoses, \*USSR.

The interaction of the different components in a biogeocenosis and the ever-increasing influence of such anthropogenic factors as radioactive fallout, pesticides (particularly DDT), and industrial wastes, are briefly reviewed, followed by discussion of the effect of human activities on the desert biogeocenoses of central Asia (USSR). The effects of hunting, irrigation, mining, livestock grazing, construction projects and other exploitation of desert areas on natural populations (carnivores, large herbivores, birds) are mentioned. Methods of increasing the productivity of desert agroecosystems, such as the introduction of a variety of plant and animal species to stabilize cotton monocultures the use of biological methods of pest control, and the exploitation of wild ungulates as a source of animal protein, are discussed. The importance of environmental protection and the maintenance of optimal interrelations between man and nature is stressed.—Copyright 1976, Biological Abstracts, Inc.

W77-00412

#### REVIEW OF PCB (POLYCHLORINATED BIPHENYLS) IN THE ENVIRONMENT,

Environmental Protection Agency, Washington,

D.C. Office of Toxic Substances.

For primary bibliographic entry see Field 5B.

W77-00463

#### ENVIRONMENTAL CONSIDERATIONS IN EXPANDING AGRICULTURAL PRODUCTION,

Latin American Program for Resources for the Future, Inc., Washington, D.C.

P. R. Crosson.

Journal of Soil and Water Conservation, Vol. 30, No. 1, p 23-28, January-February 1975.

Descriptors: \*Environment, \*Environmental effects, Agriculture, \*Crop production, Grains, Soybeans, Technology, Ecology, Demand, Foreign trade.

The environmental impacts of increasing agricultural production in the U.S. will depend upon the magnitude of the increase and the kind of technology employed to bring it about. In each case the range of possibilities is so wide that well-grounded statements about likely outcomes are difficult. The great imponderable with respect to production is the growth of foreign demand. This has been the major element in the recent dramatic shifts in prices and production of U.S. agricultural commodities, particularly grains and soybeans. U.S. farmers could easily accommodate prospective increases in domestic demand at reasonable costs, probably with a diminishing land base and a set of conservation and other measures designed to control the environmental impacts of expanded production. When the scenario is broadened to include foreign demand, however, the outlook becomes less clear and the possibility of greatly increased pressures on the environment emerges. (Skogerboe-Colo St) W77-00470

#### EPA AND AGRICULTURE: ESTABLISHING A PARTNERSHIP.

Environmental Protection Agency, Washington, D.C.

For primary bibliographic entry see Field 5G.

W77-00472

## 7. RESOURCES DATA

### 7B. Data Acquisition

#### FLOAT CALIBRATION IN INTEGRATED-FLOAT TECHNIQUES.

Department of Scientific and Industrial Research, Taupo (New Zealand), Ecology Div. P. H. John, F. A. Johnson, and P. Sutcliffe.

Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 102, No. HY8, Proceedings Paper 12308, p 1071-1082, August 1976. 9 fig, 1 tab, 15 ref, 2 append.

Descriptors: \*Calibrations, \*Measurement, \*Floats, \*Discharge(Water), Velocity, Rivers, Streams, Hydrology, Hydraulic, Instrumentation, Equations, Mathematical studies, Flow, Discharge measurement.

Identifiers: Terminal velocity.

A method of producing floats of predetermined terminal velocities without the need for individual calibration was developed for use with the integrating-float method of discharge measurement. A calibration curve relating effective density to terminal velocity was used to determine terminal velocities for individual floats, thus eliminating the need for depth or rise time measurements in the application to discharge measurement. (Lee-LSWS).

W77-00088

#### THE DESIGN OF AN INEXPENSIVE RAIN GAGE WITH BOTH AMOUNT AND RATE CAPABILITIES.

Kansas Water Resources Research Inst., Manhattan.

For primary bibliographic entry see Field 2B.

W77-00160

**MATHEMATICAL MODEL FOR PREDICTING THE CONSOLIDATION OF DREDGED MATERIAL IN CONFINED DISPOSAL AREAS,** Army Engineer Waterways Experiment Station, Vicksburg, Miss. Soils and Pavements Lab. For primary bibliographic entry see Field 5B. W77-00167

**ASSESSMENT OF PRACTICALITY OF REMOTE SENSING TECHNIQUES FOR A STUDY OF THE EFFECTS OF STRIP MINING IN ALABAMA,** Alabama Univ., University. Dept. of Geology and Geography.

For primary bibliographic entry see Field 5C.

W77-00170

**THE USE OF ERTS-1 TO MORE FULLY UTILIZE AND APPLY MARINE STATION DATA TO THE STUDY AND PRODUCTIVITY ALONG THE EASTERN SHELF WATERS OF THE UNITED STATES,** Old Dominion Univ. Research Foundation, Norfolk, Va.

For primary bibliographic entry see Field 5A.

W77-00198

**VOLUMETRIC DETERMINATION OF MARINE OIL SPILLS USING COORDINATED AIRBORNE AND SURFACE SAMPLING DATA,** California Univ. Santa Barbara.

For primary bibliographic entry see Field 5A.

W77-00214

**VERSATILE MULTIRANGE ANALYTICAL MANIFOLD FOR AUTOMATED ANALYSIS OF NITRATE-NITROGEN,** Agricultural Research Service, Watkinsville, Ga.

For primary bibliographic entry see Field 5A.

W77-00285

**BIBLIOGRAPHY ON TIDAL HYDRAULICS, SUPPLEMENTARY MATERIAL COMPILED FROM MAY 1971 TO MAY 1974, ES 816, TIDAL FLOWS IN RIVERS AND HARBORS.**

Committee on Tidal Hydraulics (Army), Washington, D.C.

For primary bibliographic entry see Field 2L.

W77-00353

**FLEXURAL STRENGTH OF LAKE ICE IN RELATION TO ITS GROWTH STRUCTURE AND THERMAL HISTORY,** Cold Regions Research and Engineering Lab., Hanover, N.H. Snow and Ice Branch.

For primary bibliographic entry see Field 2C.

W77-00354

**EFFECT OF POROSITY ON THE HYDROSTATIC COMPRESSION OF ICE,** Cold Regions Research and Engineering Lab., Hanover, N.H. Snow and Ice Branch.

For primary bibliographic entry see Field 2C.

W77-00355

**SALT FINGERS OBSERVED IN THE MEDITERRANEAN OUTFLOW REGION (34 N, 11 W) USING A TOWED SENSOR,** Massachusetts Inst., of Tech., Cambridge. Dept. of Meteorology.

For primary bibliographic entry see Field 2L.

W77-00363

**AN INVESTIGATION OF A COLD EDDY ON THE EASTERN SIDE OF THE GULF STREAM USING NOAA 2 AND NOAA 3 SATELLITE DATA AND SHIP DATA,** Research Triangle Inst., Research Triangle Park, N. C.

For primary bibliographic entry see Field 2L.

W77-00364

**GEOMORPHOLOGICAL MAPPING APPLIED TO SOIL EROSION EVALUATION,** National Inst. of Agricultural Engineering, Silsoe (England).

For primary bibliographic entry see Field 2J.

W77-00369

**DATA PROCESSING: A REVIEW OF THE ROLE OF THE MINISTRY OF WORKS AND DEVELOPMENT,** Ministry of Works, Wellington (New Zealand).

Water and Soil Div.

For primary bibliographic entry see Field 7C.

W77-00378

**BIOHYDRODYNAMIC CHANNEL FOR FIELD TRIPS, (IN RUSSIAN),** Institute of Biology of the Southern Seas, Sevastopol (USSR).

B. V. Kurbatov.

Gidrobiol Zh. 11(2), p 128-130, 1975.

Descriptors: \*Analytical techniques, \*Aquatic animals, \*Equipment, Movement.

Identifiers: \*Hydrodynamics, \*Kinematics,

\*Biohydrodynamic channel.

A specialized biohydrodynamic channel was designed and manufactured to study the kinematics and hydrodynamics of aquatic animals under field conditions. It consists of 3 dismountable sections with a total length of 6 m and 0.6 m x 0.5 m in cross section. The middle section has 2 Plexiglas viewing windows measuring 1.5 m x 0.5 m. The tachogenerator, accelerometer, cameras and other equipment are described.—Copyright 1976, Biological Abstracts, Inc.

W77-00417

**DEVELOPMENT OF A STANDARD RATING FOR THE PRICE PYGMY CURRENT METER,** Geological Survey, Jackson, Miss.

V. R. Schneider, and G. F. Smoot.

Journal of Research of the U S Geological Survey, Vol 4, No 3, p 293-297, May-June 1976. 1 fig, 7 tab, 1 ref.

Descriptors: \*Current meters, \*Flow measurement, \*Discharge(Water), \*Instrumentation, \*Standards, Quality control, Performance, Reliability, Data collections, Laboratory tests, Variability, Evaluation, Hydrometry.

Identifiers: \*Price pygmy meters, \*Flow meters(Water).

Fifty new Price pygmy current meters, 50 used Price pygmy meters with used rotors, 50 used Price pygmy meters with new rotors, and 26 used Price pygmy meters with straight uniform (nonbeaded) contact wires were rated individually in a towing tank. A standard rating of  $V = 0.961N + 0.039$  ( $V = 0.293N + 0.012$ ), where  $V$  is the velocity in feet per second (meters per second) and  $N$  is the meter rotation in revolutions per second, was established for the group of new meters. Repeated ratings of two new meters showed that under the best rating conditions, the individual Price pygmy rating is repeatable to within 1 percent. The standard errors of velocities predicted using the individual ratings and the standard ratings were compared. The use of the standard rating resulted in statistically higher standard errors than the individual ratings for all groups of meters. However, the differences are a fraction of 1 percent higher and are not of concern for practical purposes. The individual ratings and standard rating for the used meters with new straight contact wires were found to be statistically similar to the ratings for the new meters. Continuation of the use of individual ratings of Price pygmy current meters is probably unnecessary with the implementation of precise standards in their manufac-

## Field 7—RESOURCES DATA

### Group 78—Data Acquisition

ture, rating of a random sample, and use.  
(Woodard-USGS)  
W77-00432

**SUITABILITY OF CONTAINERS FOR STORAGE OF WATER SAMPLES,**  
Australian Mineral Development Labs., Adelaide.  
For primary bibliographic entry see Field 5A.  
W77-00436

**THE EFFECT OF BULK DENSITY ON NEUTRON METER CALIBRATION,**  
Commonwealth Scientific and Industrial Research Organization, Glen Osmond, (Australia). Div. of Soils.  
For primary bibliographic entry see Field 2G.  
W77-00440

**TOWARDS METHOD STANDARDIZATION: E. COLI COUNTS IN WATER SAMPLES USING MEMBRANE FILTERS, (IN TURKISH),**  
Hacettepe Universitesi, Ankara (Turkey). Dept. of Microbiology.  
For primary bibliographic entry see Field 5A.  
W77-00453

**IDENTIFICATION AND ANALYSIS OF ORGANIC POLLUTANTS IN WATER.**  
Environmental Protection Agency, Athens, Ga.  
Southeast Environmental Research Lab.  
For primary bibliographic entry see Field 5A.  
W77-00455

**THE MINERAL CONTENT IN SOIL AND SUBSOIL WATER CLOSE TO THE SURFACE BELOW CONIFEROUS AND ARABLE LAND IN SANDY SOIL OF NORTHWEST GERMANY, (IN GERMAN),**  
Landwirtschaftskammer Weser-Ems, Oldenburg (West Germany).  
For primary bibliographic entry see Field 2G.  
W77-00493

**SPECIES DIVERSITY OF FRESHWATER PLANKTON AGGLOMERATIONS, (IN POLISH),**  
K. Starykowska.  
Przeg. Zool. 18(1), p 54-57, 1974.

Descriptors: \*Zooplankton, \*Environmental effects, Ecology, Ecological distribution, Methodology.  
Identifiers: \*Species diversity.

Methods of determining the species diversity of zooplankton are presented. The problem of the dependence of species diversity on the environment, especially food and the age of the water basin are discussed. The necessity of detailed studies of the biology and population ecology of each species is stressed.—Copyright 1975, Biological Abstracts, Inc.  
W77-00495

**ON THE INFLUENCE OF WATER CURRENTS ON THE GROWTH OF HYDRORHIZAL COLONIES, (IN GERMAN),**  
Ruhr-Universitaet Bochum (West Germany). Institut fuer Spezials Zoologie.  
For primary bibliographic entry see Field 2I.  
W77-00506

**METHOD OF SIMULTANEOUS DETERMINATION OF WATER CONDUCTIVITY OF SOILS AND PLANTS, (IN RUSSIAN),**  
Moscow State Univ. (USSR). Dept. of Soil Physics and Reclamation.  
For primary bibliographic entry see Field 2I.  
W77-00512

### 7C. Evaluation, Processing and Publication

**COMPUTER EVALUATION OF SLUDGE HANDLING AND DISPOSAL COSTS,**  
Municipal Environmental Research Lab., Cincinnati, Ohio.  
For primary bibliographic entry see Field 5D.  
W77-00012

**FLOOD PLAIN INFORMATION: SOUTHAMPTON COUNTY, VIRGINIA.**  
Army Engineer District, Norfolk, Va.  
For primary bibliographic entry see Field 4A.  
W77-00104

**FLOOD PLAIN INFORMATION: RESURRECTION RIVER AND SALMON CREEK, ALASKA.**  
Army Engineer District, Anchorage, Alaska.  
For primary bibliographic entry see Field 4A.  
W77-00105

**BIOLOGICAL ASSESSMENT OF WATER QUALITY IN THREE BRITISH RIVERS: THE NORTH ESK (SCOTLAND), THE IVEL (ENGLAND) AND THE TAF (WALES),**  
Aston Univ., Birmingham (England). Dept. of Biological Sciences.  
For primary bibliographic entry see Field 5A.  
W77-00108

**OR DATA BASE INTERFACE—AN APPLICATION TO POLLUTION CONTROL,**  
Carnegie-Mellon Univ., Pittsburgh, Pa.  
For primary bibliographic entry see Field 5G.  
W77-00116

**ECONOMIC OPTIMUM RECORD LENGTH,**  
Nielsen and Rauschenberger A/S, Lyngby (Denmark).  
For primary bibliographic entry see Field 4A.  
W77-00117

**USER'S GUIDE FOR HYDROLOGIC INFORMATION STORAGE AND RETRIEVAL SYSTEM,**  
Virginia Polytechnic Inst. and State Univ., Blacksburg, Water Resources Research Center.  
For primary bibliographic entry see Field 10B.  
W77-00161

**HYDROLOGIC ENGINEERING METHODS FOR WATER RESOURCES DEVELOPMENT, VOLUME 3, HYDROLOGIC FREQUENCY ANALYSIS,**  
Hydrologic Engineering Center, Davis, Calif.  
For primary bibliographic entry see Field 4A.  
W77-00169

**STATE OF SOUTH CAROLINA WEATHER AND CROP SUMMARIES,**  
South Carolina Water Resources Commission, Columbia.  
For primary bibliographic entry see Field 3F.  
W77-00282

**PROJECT FOG DROPS V - TASK I: A NUMERICAL MODEL OF ADVECTION FOG, TASK II: RECOMMENDATIONS FOR SIMPLIFIED INDIVIDUAL ZERO-GRAVITY CLOUD PHYSICS EXPERIMENTS,**  
Calspan Corp., Buffalo, N. Y.  
For primary bibliographic entry see Field 2B.  
W77-00357

**APPENDIX 4, LIMNOLOGY OF LAKES AND EMBAYMENTS, GREAT LAKES BASIN FRAMEWORK STUDY.**  
Great Lakes Basin Commission, Ann Arbor, Mich. Public Information Office.  
For primary bibliographic entry see Field 2H.  
W77-00358

**MAPPING RUNOFF-PRODUCING ZONES IN HUMID REGIONS,**  
McGill Univ., Montreal (Quebec). Dept. of Geography.  
For primary bibliographic entry see Field 4A.  
W77-00368

**GEOMORPHOLOGICAL MAPPING APPLIED TO SOIL EROSION EVALUATION,**  
National Inst. of Agricultural Engineering, Silsoe (England).  
For primary bibliographic entry see Field 2J.  
W77-00369

**TOWARDS A COMPUTER-BASED INFORMATION-RETRIEVAL SYSTEM FOR GROUND-WATER DATA,**  
New Zealand Geological Survey, Christchurch.  
R. B. McCammon.  
Journal of Hydrology (New Zealand), Vol. 14, No. 1, p 9-19, 1975. 3 fig, 1 tab, 2 ref, 1 append.

Descriptors: \*Information retrieval, \*Data storage and retrieval, \*Groundwater, \*Well data, \*Data collections, Basic data collections, Hydrologic data, Wells, Water wells, Computers, Computer programs, Automation.  
Identifiers: \*New Zealand.

In the near future, most regional water boards in New Zealand will have on-going investigations into underground water. Because underground water represents a hidden resource, indirect methods, namely well drilling, must be used in any attempt to better understand underground water supplies. The information obtained from boreholes therefore is of paramount importance. With the greater number of wells being drilled at present, together with the well records already on file, computer-based systems for information retrieval offer definite promise for the future. A key factor in the design of such a system is the nature of the man-computer dialogue. Question-and-answer, menu-selection and natural-English type dialogues are particularly well suited for the retrieval of water-well records from data files. Whichever system is put forward, it is important that potential users of the system be involved in all stages of development. (Sims-ISWS)  
W77-00377

**DATA PROCESSING: A REVIEW OF THE ROLE OF THE MINISTRY OF WORKS AND DEVELOPMENT,**  
Ministry of Works, Wellington (New Zealand). Water and Soil Div.  
R. P. Ibbitt.  
Journal of Hydrology (New Zealand), Vol. 14, No. 1, p 21-29, 1975. 3 ref.

Descriptors: \*Data storage and retrieval, \*Information retrieval, \*Data processing, \*Data collections, Hydrologic data, Surface waters, Precipitation (Atmospheric), Rainfall, Water levels, Groundwater, Instrumentation, Equipment, Computers, Computer programs, Automation.  
Identifiers: \*New Zealand.

When instrumentation is chosen for collecting data, decisions are made, often implicitly, about the purposes for which the data are to be collected and about the accuracy needed to fulfill these purposes. Frequently, unforeseen circumstances affect the type of instrument required or the objective(s) for which the data are being collected.



Some of the consequences of the use of inappropriate instruments were examined. A description was then given of the different types of data currently being processed by the Ministry of Works and Development and of how the type of data affects the processing. The relative merits of different forms of publication based on the data were discussed, and the conclusions led to a description of the ways in which users can obtain the data. (Sims-ISWS)  
W77-00378

**DECISION-MAKING IN RECREATIONAL FISHERIES MANAGEMENT: AN ANALYSIS,** Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Fisheries and Wildlife Sciences.  
For primary bibliographic entry see Field 6B.  
W77-00391

**HYDROLOGIC UNIT MAP--1974, STATE OF IOWA**  
Geological Survey, Reston, Va.  
Hydrologic Unit Map of Iowa, 1976. 1 sheet.

Descriptors: \*Maps, \*Hydrology, \*Iowa, Water resources, Data collections, Planning, Hydrologic systems, Regions, Land resources.  
Identifiers: \*Hydrologic unit maps(Iowa), \*Hydrologic boundaries, Subregions, Accounting units, Cataloging units.

This map and accompanying table show Hydrologic Units in Iowa that are basically hydrographic in nature. The Cataloging Units shown will supplant the Cataloging Units previously used by the U.S. Geological Survey in its Catalog of Information on Water Data (1966-72). The Regions, Subregions and Accounting Units are aggregates of the Cataloging Units. The Regions and Subregions are currently (1974) used by the U.S. Water Resources Council for comprehensive planning, including the National Assessment, and as a standard geographical framework for more detailed water and related land-resources planning. The Accounting Units are those currently (1974) in use by the U.S. Geological Survey for managing the National Water Data Network. (Woodard-USGS)  
W77-00425

**HYDROGEOLOGIC DATA FROM THE GREAT BEND PRAIRIE, SOUTH-CENTRAL KANSAS,** Geological Survey, Lawrence, Kans.  
For primary bibliographic entry see Field 4B.  
W77-00426

**MEAN ANNUAL RUNOFF IN THE UPPER OHIO RIVER BASIN, 1941-70, AND ITS HISTORIC VARIATION,** Geological Survey, Harrisburg, Pa.  
For primary bibliographic entry see Field 2E.  
W77-00428

**HYDROLOGIC UNIT MAP--1974, STATE OF WYOMING.**  
Geological Survey, Reston, Va.  
For sale by USGS, Reston, Va., 22092, price \$1.25. Hydrologic Unit Map of Wyoming, 1976. 1 sheet, 1 map.

Descriptors: \*Maps, \*Hydrology, \*Wyoming, Water resources, Data collections, Planning, Hydrologic systems, Regions, Land resources.  
Identifiers: \*Hydrologic unit maps(Wyo), \*Hydrologic boundaries, Subregions, Accounting units, Cataloging units.

This map and accompanying table show Hydrologic Units in Wyoming that are basically hydrographic in nature. The Cataloging Units shown will supplant the Cataloging Units previously used by the U.S. Geological Survey in its Catalog of Information on Water Data (1966-72). The Regions,

Subregions and Accounting Units are aggregates of the Cataloging Units. The Regions and Subregions are currently (1974) used by the U.S. Water Resources Council for comprehensive planning, including the National Assessment, and as a standard geographical framework for more detailed water and related land-resources planning. The Accounting Units are those currently (1974) in use by the U.S. Geological Survey for managing the National Water Data Network. (Woodard-USGS)  
W77-00429

**GROUND-WATER LEVELS IN THE UNITED STATES, 1970-74: SOUTH-CENTRAL STATES.** Geological Survey, Reston, Va.  
For primary bibliographic entry see Field 4B.  
W77-00430

**SURFACE WATER SUPPLY OF THE UNITED STATES, 1966-70: PART 4. ST. LAWRENCE RIVER BASIN--VOLUME 2. ST. LAWRENCE RIVER BASIN BELOW LAKE HURON.** Geological Survey, Reston, Va.  
For primary bibliographic entry see Field 4A.  
W77-00431

**DEVELOPMENT OF A STANDARD RATING FOR THE PRICE PYGMY CURRENT METER,** Geological Survey, Jackson, Miss.  
For primary bibliographic entry see Field 7B.  
W77-00432

**FLOODS OF MARCH-APRIL 1973 IN SOUTHEASTERN UNITED STATES,** Geological Survey, Reston, Va.  
For primary bibliographic entry see Field 2E.  
W77-00434

**WATER RESOURCES DATA FOR ALABAMA, WATER YEAR 1975.** Geological Survey, Tuscaloosa, Ala.  
Water-Data Report AL-75-1, 1975. 377 p, 7 fig, 3 tab, 46 ref.

Descriptors: \*Alabama, \*Hydrologic data, \*Surface waters, \*Groundwater, \*Water quality, Flow rates, Gaging stations, Lakes, Reservoirs, Chemical analysis, Sediments, Water temperature, Sampling sites, Water levels, Water analysis, Basic data collections.

Water resources data for the 1975 water year for Alabama consists of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and water levels in wells. This report contains discharge records for 97 gaging stations; stage and contents for 12 lakes and reservoirs; water quality for 44 stations and water levels for 47 observation wells. Also included are data from crest-stage partial-record stations. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Alabama. (Woodard-USGS)  
W77-00435

**A WATER BALANCE MODEL AND SUPPLY INDEX FOR WHEAT IN SOUTH AUSTRALIA,** Commonwealth Scientific and Industrial Research Organization, Adelaide (Australia). Div. of Soils.  
For primary bibliographic entry see Field 3F.  
W77-00444

**STOICHIOMETRIC DISTANCE AND TOTAL CONCENTRATION: A BINARY NUMERICAL DESCRIPTION OF INLAND WATER CHEMISTRY,** Tasmania Univ., Hobart (Australia). Dept. of Botany.  
For primary bibliographic entry see Field 2K.  
W77-00449

**DIGITAL SIMULATION OF A BASALT AQUIFER SYSTEM, WALLA WALLA RIVER BASIN, WASHINGTON AND OREGON,** Geological Survey, Tacoma, Wash.  
For primary bibliographic entry see Field 4B.  
W77-00481

**GROUND-WATER DATA FOR ATTALA COUNTY, MISSISSIPPI,** Geological Survey, Jackson, Miss.  
B. E. Wasson.  
Mississippi Board of Water Commissioners, (Jackson), County Report No 4, 1976. 26 p, 3 fig, 3 tab, 7 ref.

Descriptors: \*Groundwater resources, \*Well data, \*Aquifers, \*Water quality, \*Mississippi, Water levels, Water users, Drillers logs, Chemical analysis, \*Water wells, Data collections.  
Identifiers: \*Attala County(Miss), Sand intervals, Electric logs.

This is one in a series of ground-water basic-data reports being prepared for the 82 counties of Mississippi to meet the need for information about the availability and quality of water in the State. The data for Attala County are presented in three tables: (1) well descriptions, (2) chemical analyses, and (3) sand intervals from electric logs. Three maps show the locations of the wells for which data are presented. (Woodard-USGS)  
W77-00484

**MAXIMUM KNOWN STAGES AND DISCHARGES OF NEW YORK STREAMS THROUGH 1973,** Geological Survey, Albany, N.Y.  
I. R. Leonard, and B. Dunn.  
New York State Department of Environmental Conservation, Albany, Bulletin 72, 1976. 67 p.

Descriptors: \*Peak discharge, \*Flood stages, \*Streams, \*New York, Hydrologic data, Gaging stations, Data collections, Discharge frequency.  
Identifiers: Maximum discharge stages, Period-of-record maximum discharges.

This report is a compilation of all known maximum stages and discharges of New York streams in the files of the U.S. Geological Survey, including some data furnished by other Federal, State, and private organizations. The compilation is an updating of New York State Water Resources Commission Bulletin 67 published in 1970 and includes data through 1973. Maximum stages and rates of discharge have been determined at regular gaging stations, partial-record stations, and at other locations where data became available after floods since about 1900 under cooperative agreement between the State of New York and the U.S. Geological Survey. (Woodard-USGS)  
W77-00485

**SEDIMENT DISCHARGE IN THE UPPER ARROYO GRANDE AND SANTA RITA CREEK BASINS, SAN LUIS OBISPO COUNTY, CALIFORNIA,** Geological Survey, Menlo Park, Calif.  
For primary bibliographic entry see Field 2J.  
W77-00487

## 8. ENGINEERING WORKS

### 8B. Hydraulics

**FLOW APPROACHING FILTER WASHWATER TROUGHS,** Camp, Dresser and McKee, Inc., Boston, Mass.  
For primary bibliographic entry see Field 5D.  
W77-00053

## Field 8—ENGINEERING WORKS

### Group 8B—Hydraulics

#### SOURCE AND TRIBUTARY-SOURCE LINK LENGTHS IN NATURAL CHANNEL NETWORKS

New South Wales Univ., Kensington (Australia). School of Geography.  
A. D. Abrahams, and R. N. Campbell.  
Geological Society of America Bulletin, Vol. 87, No. 7, p 1016-1020, July 1976. 5 fig, 2 tab, 11 ref.

Descriptors: \*Australia, \*Channel morphology, \*Drainage patterns(Geologic), \*Drainage, Drainage systems, Basins, Geomorphology, On-site investigations, Statistics, Tributaries, Networks.  
Identifiers: \*Basin morphometry, \*Channel networks, Link-length properties, Tributary source, Natural channel networks.

Exterior links may be classified according to the type of link they join at their downstream end. Those which join another exterior link are termed 'source links,' and those which join an interior link are termed 'tributary-source links.' The length distributions of source and tributary-source links were compared for two areas in eastern Australia where channel networks have developed in dissimilar materials under disparate climatic conditions and have reached quite different stages of evolution. Statistical tests confirmed that these two types of links have different length distributions in both areas. In particular, there tended to be relatively more short, and therefore relatively fewer long, source links than tributary-source links. Analyses of length data for both types of links from other areas gave similar results. It was concluded that there are inherent differences between the lengths of source and tributary-source links in natural channel networks. These differences were attributed to a tendency for the lengths of tributary-source links to increase downstream as the lengths of the main valley sides on which they have developed increase. (Lee-ISWS)

W77-00084

**GULLY DEVELOPMENT AND CONTROL: THE STATUS OF OUR KNOWLEDGE,**  
Forest Service (USDA), Tempe, Ariz. Rocky Mountain Forest and Range Experiment Station.  
For primary bibliographic entry see Field 2J.  
W77-00097

**OPTIMAL DESIGN OF SINGLE RESERVOIR SYSTEM USING (DELTA) RELEASE POLICY,**  
California Polytechnic State Univ., San Luis Obispo. Dept. of Computer Science and Statistics.  
For primary bibliographic entry see Field 4A.  
W77-00109

**ROLE OF EDDY DIFFUSIVITY IN THERMOCLINE FORMATION,**  
Leicester Univ. (England). Dept. of Engineering.  
For primary bibliographic entry see Field 2H.  
W77-00139

**ANALYTICAL SOLUTION FOR 3-D DIFFUSION MODEL,**  
Envirosphere/EBASCO, New York.  
For primary bibliographic entry see Field 5B.  
W77-00141

**HYDROLOGIC ENGINEERING METHODS FOR WATER RESOURCES DEVELOPMENT, VOLUME 3, HYDROLOGIC FREQUENCY ANALYSIS,**  
Hydrologic Engineering Center, Davis, Calif.  
For primary bibliographic entry see Field 4A.  
W77-00169

**ENERGY GRADIENT LINE FOR DRIP IRRIGATION LATERALS,**  
Hawaii Univ., Honolulu. Dept. of Agricultural Engineering.

For primary bibliographic entry see Field 3F.  
W77-00318

**ADJUSTMENT OF STREAM-CHANNEL SHAPE TO HYDROLOGIC REGIME,**  
Papua and New Guinea Univ., Port Moresby (New Guinea). Dept. of Geography.  
G. Pickup.  
Journal of Hydrology, Vol. 30, No. 4, p 365-373, August 1976. 1 fig, 1 tab, 14 ref.

Descriptors: \*Sediment transport, \*Channels, \*Geomorphology, \*Bed load, Streams, Sediment load, Mathematical studies, Streamflow, Hydraulics, Discharge(Water), Equations.  
Identifiers: \*Hydrologic regime, Channel geometry, Channel width, Dominant discharge.

Bed load channels tend to adjust their cross-sections so that, given slope, roughness, and sediment load, channel shape approaches the optimum for bed load transport. The extent to which any one shape is the optimum varies with discharge, so four Cumberland Basin stream channels were investigated to determine the discharges at which their present cross-sections represent the optimum for bed load transport. These discharges had return periods ranging from 1.1 to 1.5 years on the annual series. The return periods closely corresponded with return periods for the discharge at which, over a period of time, the most bed load is transported. These return periods varied from 1.15 to 1.45 years when the same bed load equation was used. The close correspondence between sets of return periods suggested that bed load channels tend to adjust their cross-sections to become the optimum shape for bed load transport at or close to the discharge at which the most bed load transport is accomplished. (Lee-ISWS)

W77-00379

**SIMILITUDE IN COASTAL ENGINEERING,**  
Tetra Tech. Inc., Pasadena, Calif.  
B. LeMehaute.  
Journal of the Waterways, Harbors and Coastal Engineering Division, American Society of Civil Engineers, Vol. 102, No. WW3, Proceedings Paper 12293, p 317-335, August 1976. 2 fig, 13 ref.

Descriptors: \*Model studies, \*Sediment transport, Waves(Water), Coastal engineering, Hydraulic models, Hydraulics, Equations, Froude number, Reynolds number, Head loss, Structures, Beds.  
Identifiers: \*Similitude, \*Scale effect, Scale models, Wave energy, Froude similitude, Reynolds similitude, Movable bed models.

The basic principles of the engineering approach to similitude were given with emphasis on coastal engineering applications. In contrast to the parallel that exists between the Froude similitude and the Reynolds similitude as it is often formerly presented, the parallel between the similitude of 'short' model and similitude of 'long' model was stressed as the most practical engineering approach to scale model technology. Scale effects were determined quantitatively as the results of viscous damping and capillary effects. Density effects were examined, and the problem of similitude of wave forces—or more generally of time-dependent phenomena—were quantitatively determined. Some digressions on movable bed scale models were also presented. (Lee-ISWS)

W77-00380

**EFFECTS OF NEAR-WELL PERMEABILITY VARIATION ON WELL PERFORMANCE,**  
New South Wales Univ., Kensington (Australia). Water Research Lab.  
For primary bibliographic entry see Field 4B.  
W77-00437

**DRILLING MUD INVASION OF UNCONSOLIDATED AQUIFER MATERIALS,**  
New South Wales Univ., Kensington (Australia). Water Research Lab.  
C. R. Dudgeon, and R. J. Cox.  
Australian Water Resources Council, Canberra, Technical Paper No. 17, 1976. 216 p, 15 fig, 2 tab, 23 ref, append.

Descriptors: \*Drilling fluids, \*Unconsolidated aquifers, \*Water wells, \*Water yield, Drilling, Boreholes, Aquifer characteristics.

All drilling methods impair the ability of an aquifer to deliver water to the drilled hole; where drilling mud is used, and aquifer pores are large enough, the excess hydrostatic head relied upon to maintain the open hole will force the mud and cuttings into the surrounding aquifer. Details of a series of tests with commonly used drilling muds, to examine development of filter cakes, the depth of mud invasion, and the degree of permanent formation damage under various flow conditions, are presented. Guidelines are provided for the choice and use of drilling fluid materials. (CSIRO)

W77-00438

### 8C. Hydraulic Machinery

**TUNNELLING MACHINE USED FOR DRAIN TUNNEL FOR ROUNDHILL SEWAGE TREATMENT WORKS BREAKS RECORD,**  
Water Services, Vol 80, No 963, p 312, 316, May, 1976.

Descriptors: \*Tunnel construction, \*Tunnel design, \*Tunneling machines, \*Tunneling, \*Drainage systems, Sewage treatment, Treatment facilities, Equipment, Construction, Hydraulic structures, Drains.

The construction of a 500-meter drain tunnel for a sewage treatment works is discussed, with particular emphasis on the tunnelling machine used which did the job in record time. The material being tunnelled consisted of Bunter pebble beds and Bunter sandstone. The tunnel shape chosen was one with a straight base and an arched roof. The machine chosen to drive the tunnel was an Atlas Copco Mini Full Facer which has also proven itself in such materials as dolomitic limestone, abrasive limestone, and metamorphous limestone. Up to 35.5 meters of tunnelling was accomplished in one day (20 digging hours) with the machine as compared to the previous record of 22 meters. The initial entry of the machine was aided by the construction of concrete walls at the starting end in order that the gripper pads would have solid material to push against. The machine is designed to work in a depth of 1 foot of water. (Kreager-FIRL)

W77-00069

**PLANNING AND CONSTRUCTION OF BIRMINGHAM'S MAIN OUTFALL SEWER,**  
Metropolitan Borough of Wolverhampton (England). Dept. of Technical Services.  
For primary bibliographic entry see Field 5D.  
W77-00072

**SEWER FORCE MAIN HELPS SOLVE POLLUTION PROBLEM,**  
For primary bibliographic entry see Field 5D.  
W77-00075

**KAMINISTUIA INTERCEPTOR SEWER COMPLETED IN THUNDER BAY,**  
For primary bibliographic entry see Field 5D.  
W77-00076

**EVALUATION OF MULTI-PURPOSE OFFSHORE INDUSTRIAL-PORT ISLANDS.**

# **VOL II: MAJOR RESEARCH PROBLEMS AND PROMISING RESEARCH APPROACHES,**

Delaware Univ., Newark. Coll. of Marine Studies. W. S. Gaither.  
Available from the National Technical Information Service, Springfield VA 22161 as PB-248 335, Price codes: A21 in paper copy, A01 in microfiche. Delaware University College of Marine Studies Final Workshop Report to NSF-RANN No. NSF-RA-E-75-054B, May 1975. 95 p, 9 append. NSF-GI-43111.

Descriptors: \*Islands, \*Economics, \*Environmental effects, \*Structure, \*Construction, Legal aspects.  
Identifiers: \*Artificial islands(Ports), U.S. East Coast, Gulf Coast, Deepwater ports, Islands(Artificial), Islands(Man-made), Offshore industrial islands.

This study was designed to evaluate the economic engineering, legal, and environmental possibility of large (four to six square mile) artificial industrial ports located off the U.S. Atlantic and Gulf Coasts, and is reported in two volumes. This volume describes the procedures and results from the workshop which was conducted to identify major problems and promising approaches to solve the problems associated with man-made islands. The workshop was divided into the following functional groups: (1) Economics and Finance; (2) Industrial Tenants; (3) Environmental; (4) Legal and Institutional; and (5) Structure and Construction. (Sinha-OEIS)  
W77-00199

## **8D. Soil Mechanics**

**SOIL BULK DENSITIES AFTER THIRTY YEARS UNDER DIFFERENT MANAGEMENT REGIMES.**  
Grand Valley State Coll., Allendale, Mich. Dept. of Environmental Science.  
For primary bibliographic entry see Field 2G.  
W77-00287

## **8E. Rock Mechanics and Geology**

**ADJUSTMENT OF STREAM-CHANNEL SHAPE TO HYDROLOGIC REGIME.**  
Papua and New Guinea Univ., Port Moresby (New Guinea). Dept. of Geography.  
For primary bibliographic entry see Field 8B.  
W77-00379

## **8F. Concrete**

**A RETROSPECTIVE ON THE STRUCTURAL STABILITY OF RCC SPUN SEWER PIPES.**  
National Water Authority of Jamaica (Kingston).  
For primary bibliographic entry see Field 5D.  
W77-00073

## **8G. Materials**

**LARGE-DIAMETER CORRUGATED STEEL PIPE ENTERS STORM SEWER FIELD.**  
For primary bibliographic entry see Field 5D.  
W77-00074

## **8I. Fisheries Engineering**

**EFFECT OF IRRIGATION PUMPING ON DESERT PUPFISH HABITATS IN ASH MEADOWS, NYE COUNTY, NEVADA.**  
Geological Survey, Carson City, Nev.  
W. W. Dudley, Jr., and J. D. Larson.

Available from USGS, 604 S. Pickett St. Alexandria, Va. 22304, price \$1.45. Professional Paper 927, 1976. 52 p, 24 fig, 8 tab, 29 ref.

Descriptors: \*Ecology, \*Fish, \*Irrigation, \*Pumping, \*Groundwater, Environmental effects, Arid lands, Lakes, Collapse, \*Nevada, Irrigation water, Springs.  
Identifiers: \*Desert pupfish, \*Rare fish species, \*Cyprinodon, Devils Hole(Nev).

The Ash Meadows area, at the southern tip of the Amargosa Desert in southern Nevada, discharges ground water collected over several thousand square miles of a regional flow system developed in Paleozoic carbonate rocks. Water moves westward across fault contacts from the bedrock into poorly interconnected gravel, sand, and terrestrial-limestone aquifers in the upper few hundred feet of the basin sediments at Ash Meadows. A small pool in Devils Hole, which is a collapse depression in Cambrian limestone, and numerous springs in the adjacent desert valley contain rare fish species of the genus *Cyprinodon*, faunal remnants of Pleistocene lakes. The Devils Hole pupfish, *C. diabolis*, is the most endangered of the several surviving species that have evolved since the post-pluvial isolation of their ancestors. This population feeds and reproduces on a slightly submerged rock ledge. Recent irrigation pumping has nearly exposed this ledge. Correlation of pumping histories with the stage in Devils Hole allows identification of several wells that affect the pool level most severely. Some springs that are habitats for other species of *Cyprinodon* have reduced discharge because of pumping. Hydraulic testing, long-term water-level monitoring, water quality, and geologic evidence aid in defining the principal flow paths and hydraulic interconnections in the Ash Meadows area. (Woodard-USGS)  
W77-00427

## **9. MANPOWER, GRANTS AND FACILITIES**

### **9A. Education (Extramural)**

**GRADUATE EDUCATION OPPORTUNITIES IN WATER RESOURCES IN THE STATE OF MINNESOTA.**  
Minnesota Univ., Minneapolis. Water Resources Research Center.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-258 881, Price codes: A03 in paper copy, A01 in microfiche. Bulletin 89, July 1976, 50 p. OWRT A-999-MINN (41), 14-34-0001-6024.

Descriptors: \*Minnesota, \*Education, \*Colleges, \*Universities, Training, Scientific personnel, Engineering education.  
Identifiers: \*Graduate education.

Information is presented pertaining to graduate programs and courses related to water resources, and on faculty members having interests in water resources in colleges and universities in Minnesota. (Waelti-Minnesota)  
W77-00156

## **10. SCIENTIFIC AND TECHNICAL INFORMATION**

### **10B. Reference and Retrieval**

**USER'S GUIDE FOR HYDROLOGIC INFORMATION STORAGE AND RETRIEVAL SYSTEM.**  
Virginia Polytechnic Inst. and State Univ., Blacksburg. Water Resources Research Center. T. W. Johnson, J. Wysor, and R. Marchany.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-258 873, Price codes: A04 in paper copy, A01 in microfiche. Research Report, July 1975. 75 p, 16 fig. OWRT A-045-NC(1).

Descriptors: \*Computer programs, \*Programs, \*Data collections, \*Information retrieval, Computers, Data processing, Data storage and retrieval, Streamflow, Temperature, Rainfall.

The Hydrologic Information Storage and Retrieval System (HISARS) was developed at the University of North Carolina. It is a computerized system in which masses of streamflow, temperature, rainfall, and allied data are stored. The data can be accessed and processed in many ways. This guide is intended to serve as a self-contained reference for use of the system access facilities. (Froehlich-ISWS)  
W77-00161

## **10C. Secondary Publication And Distribution**

**USER'S GUIDE FOR HYDROLOGIC INFORMATION STORAGE AND RETRIEVAL SYSTEM.**  
Virginia Polytechnic Inst. and State Univ., Blacksburg. Water Resources Research Center.  
For primary bibliographic entry see Field 10B.  
W77-00161

**COASTAL ZONE BIBLIOGRAPHY: CITATIONS TO DOCUMENTS ON PLANNING, RESOURCES MANAGEMENT AND IMPACT ASSESSMENT, SECOND EDITION.**  
California Univ., San Diego, La Jolla. Inst. of Marine Resources.  
For primary bibliographic entry see Field 2L.  
W77-00277

**ANNOTATED BIBLIOGRAPHY ON TRICKLE IRRIGATION.**  
Colorado State Univ., Fort Collins. Dept. of Agricultural Engineering.  
For primary bibliographic entry see Field 3F.  
W77-00315

**BIBLIOGRAPHY ON TIDAL HYDRAULICS, SUPPLEMENTARY MATERIAL COMPILED FROM MAY 1971 TO MAY 1974, ES 816, TIDAL FLOWS IN RIVERS AND HARBORS.**  
Committee on Tidal Hydraulics (Army), Washington, D.C.  
For primary bibliographic entry see Field 2L.  
W77-00353

## **10D. Specialized Information Center Services**

**EFFECTIVENESS OF INFORMATION TRANSFER THROUGH WATER RESOURCES RESEARCHER/USER GROUP INTERACTION.**  
Massachusetts Univ., Amherst. Water Resources Research Center.  
R. Kreplick, and J. C. Sawyer.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-258 767, Price codes: A09 in paper copy, A01 in microfiche. WRC Pub. No. 73, Completion Report FY-76-17, June 1976. 144 p, 1 fig, 11 tab, 79 ref, 8 append. OWRT A-076-MASS(1). 14-31-0001-5021.

Descriptors: \*Information exchange, Technology, Information retrieval, Communication, \*Attitudes.  
Identifiers: \*Information transfer, \*Technology transfer.



## Field 10—SCIENTIFIC AND TECHNICAL INFORMATION

### Group 10D—Specialized Information Center Services

The interpersonal user group approach was utilized to communicate relevancy of water resources research to local, state, and federal agency personnel. Approximately 100 professionals participated in stages of the project, from experience interviews to interaction in 18 informal meetings. Discussion is presented in the context of pertinent studies, communication patterns and systems, perceptions of institutional arrangements, current utilization and fields related to research utilization. The effectiveness of interpersonal communication was measured by a questionnaire on the awareness and attitude dimensions. Auxiliary measures included an in-meeting observational technique, and content analysis of taped meetings categorized according to questionnaire dimensions. The awareness items concentrated on knowledge, prior contact, and sources utilized; the attitude scale included applicability of research, the need for user/researcher contact, and research availability. Results showed some significant positive change in awareness responses. Reaction to the Likert scale showed an intuitively neutral to slightly positive result on pre- and post-test for both users and researchers although individual items showed significant positive change. Researchers and users were positive about the need for contact and user input in formulating research questions; however, political and economic considerations and user/researcher perceptions of each group's practical problems showed neutral to negative reactions. Content analysis supported questionnaire results. The findings showed both the potentials and the barriers to interpersonal interaction. However, the user group mechanism is recommended for continued feedback for the utilization of water resources research.

W77-00151

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